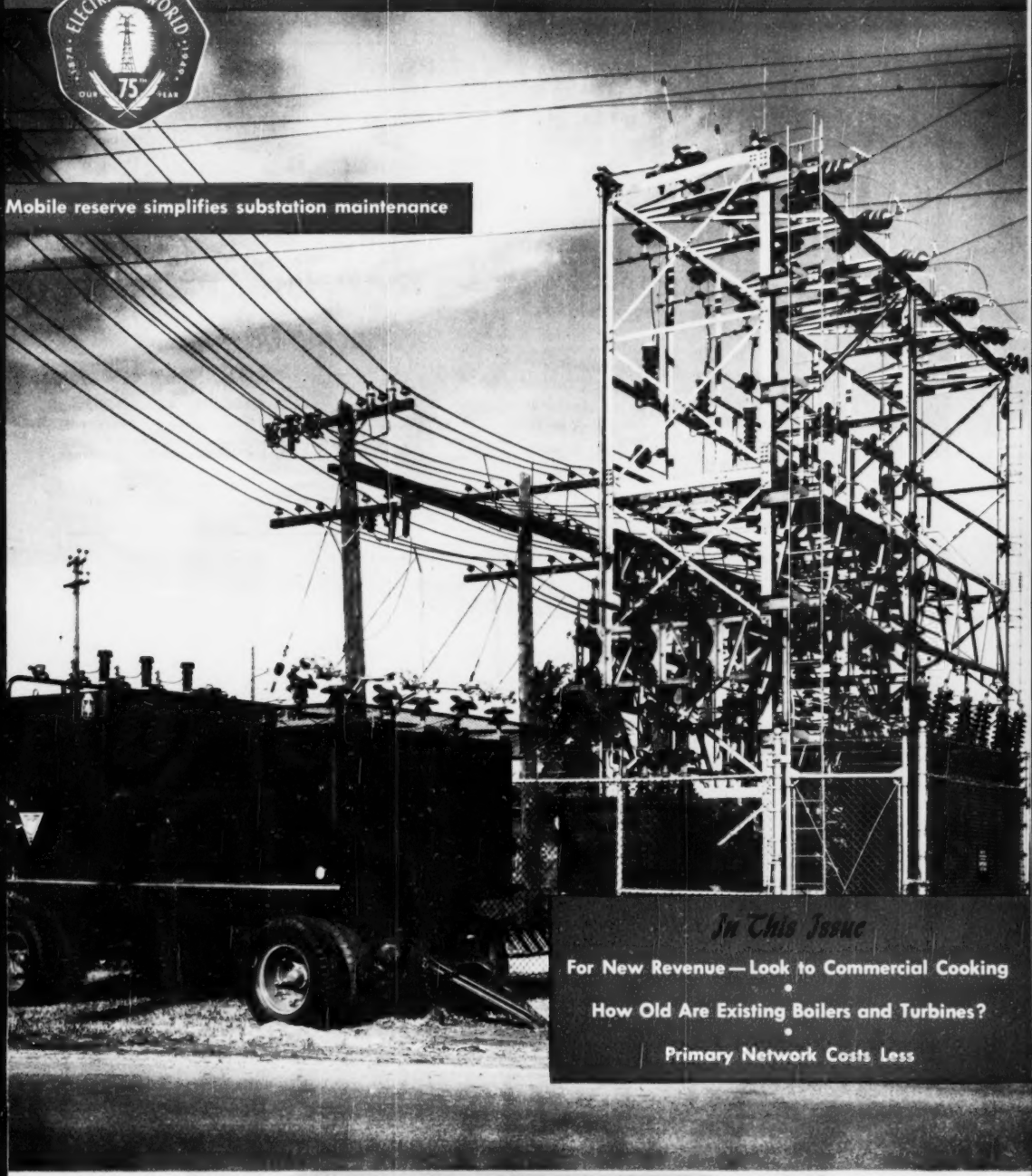
# ELECTRICAL WORLD

A McGRAW-HILL PUBLICATION

OCTOBER 8, 1949

ELECTRICAL WORLD 1874 1949 OUR 75TH YEAR



Mobile reserve simplifies substation maintenance

In This Issue

For New Revenue—Look to Commercial Cooking

How Old Are Existing Boilers and Turbines?

Primary Network Costs Less

*(Model 901) PORTABLE TEST INSTRUMENTS* available in DC, Model 901—and AC, Model 904, single and multiple ranges of wide coverage. Excellent scale readability and shielding. Accuracy within ½ of 1%.

*SENSITIVE RELAYS* a line of sensitive relays including the Model 705 which provides positive control at levels as low as ½ microampere. Non-chattering magnetic contacts handle up to 10 watts at 120 volts.

*(Model 622) ULTRA-SENSITIVE INSTRUMENTS* portable DC and AC Thermo instruments for precision measurement of potentials and minute currents involving electronics, thermo-couples or laboratory research.

# INSTRUMENTS

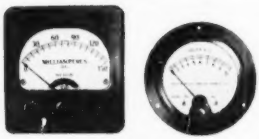
## TO SPEED AND SIMPLIFY ELECTRONIC PRODUCTION AND MAINTENANCE

Illustrated are but a few of the many specialized instruments available from WESTON . . . all designed to simplify and speed-up electrical and electronic installations, production testing, and maintenance. For details, see your local representative, or write Weston Electrical Instrument Corporation, 618 Frelinghuysen Avenue, Newark 5, New Jersey.

**WESTON** *Instruments*

ALBANY • ATLANTA • BOSTON • BUFFALO • CHARLOTTE • CHICAGO
CINCINNATI • CLEVELAND • DALLAS • DENVER • DETROIT • HOUSTON
JACKSONVILLE • KNOXVILLE • LITTLE ROCK • LOS ANGELES
MERIDEN • MINNEAPOLIS • NEWARK • NEW ORLEANS • NEW YORK
ORLANDO • PHILADELPHIA • PHOENIX • PITTSBURGH • ROCHESTER
SAN FRANCISCO • SEATTLE • ST. LOUIS • SYRACUSE • TULSA
IN CANADA, NORTHERN ELECTRIC CO., LTD., POWERLITE DEVICES, LTD.

*(Model 798) MULTI-PURPOSE TUBE-CHECKER* offering provision for testing Receiving Tubes — Voltage Regulator Tubes—Light Duty Thyratron Tubes such as 2A4—6D4—884—885—2051. Scale is calibrated "Good-Bad" as well as in mutual conductance range.

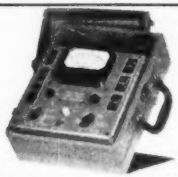


*PANEL and SWITCHBOARD INSTRUMENTS* a complete line of instruments in all types, sizes and ranges required for switchboard and panel needs . . . including DC, AC power frequencies and radio frequency, rectifier types and D.B. meters.

*(Model 697) VOLT-OHM MILLIAMMETER* one of a line of pocket-size meters, Model 697 combines a selection of AC and DC voltage, DC current, and resistance ranges. Ideal for maintenance testing and many inspection requirements.

*(Model 785) INDUSTRIAL CIRCUIT TESTER* a versatile, portable tester for laboratory or maintenance needs, where an ultra-sensitive instrument is required. Provides 27 AC and DC voltage, AC and DC current, and resistance ranges. (DC sensitivity 20,000 ohms per volt.)

*(Model 779, Type 1) SUPER-SENSITIVE ANALYZER* small, light, compact, 26 range Volt-Ohm-Milliammeter with 5 DC voltage ranges, sensitivity of 1000 or 20,000 ohms per volt. AC temperature compensated. Self-contained power supply. Ideal for many production and test requirements.



*(Model 769) ELECTRONIC ANALYZER* incorporating a conventional Volt-Ohm-Milliammeter with self-contained power source—a high-impedance electronic Volt-Ohmmeter using 115 volt, 60 cycle power—a stable, probe-type, Vacuum Tube Voltmeter, for use to 300 megacycles.

# ELECTRICAL WORLD

Published for 75 years for those engaged in the business of generating, transmitting, distributing or applying electric power

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# WHEN YOU'RE FIGURING CABLE COSTS* USE THESE FACTS ON FILE ABOUT OKONITE

4700 feet of Okonite Underground Cable in service since 1908..... Removed and Re-Used in 1948

2000 feet of Okovar Varnished Cambric Cable Installed Overhead and put in service in 1927..... Removed and Re-Used in 1948.

In the files of The Okonite Company are a number of case histories that tell their own story of the long life—the real yardstick of cable economy—that you can count on with Okonite. The two instances cited above are from the records of a single customer.

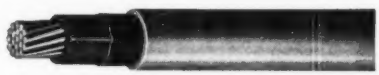
They are two of eleven instances of cables long used and transferred to new locations by this customer, who has re-installed more than 24 miles of such Okonite cable.

Building true value into cable has been Okonite's business since 1878. What goes into an Okonite cable to make it do a better job...what tests it must pass...what care is taken to control its electrical characteristics—all this and other data are found in Research Bulletin EW-101, For a copy, address The Okonite Company, Passaic, New Jersey.

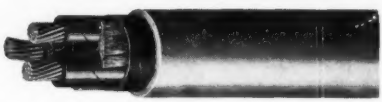
THE BEST CABLE IS YOUR BEST POLICY

***with today's installation costs only the *Longest-Lived* will be economical.....**

The lifetime cost of a cable rather than its first cost is the only true measure. Okonite wires and cables, built to stand up better and longer, can offset high installation costs.



Okonite rubber insulated lead-covered underground cable.



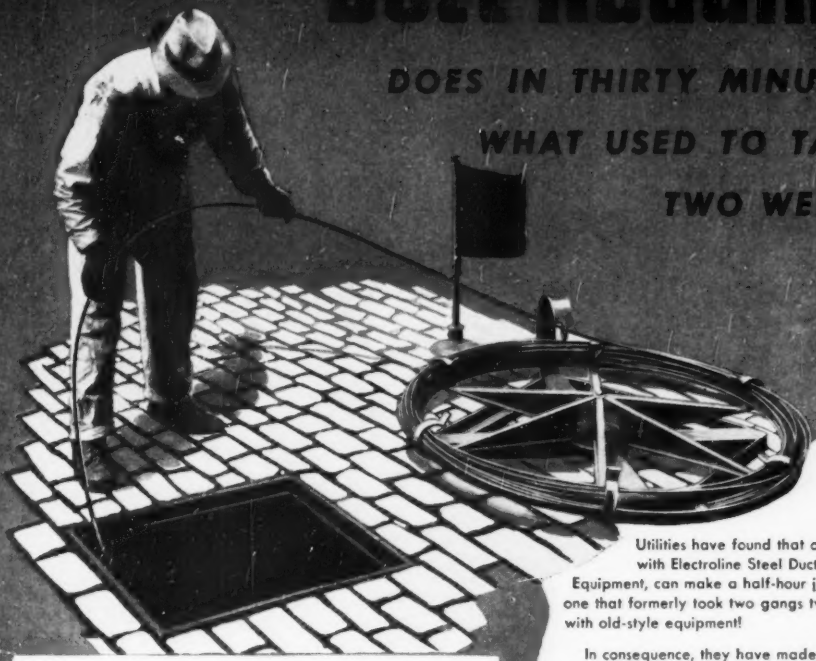
Okover varnished cambric lead-covered aerial power cable.

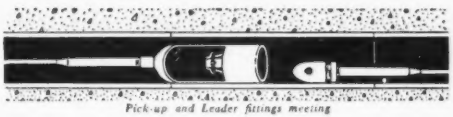
7421

OKONITE insulated wires and cables

# Electroline Duct Rodding

## DOES IN THIRTY MINUTES WHAT USED TO TAKE TWO WEEKS

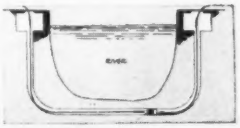




*Pick-up and Leader fittings meeting*

*Right, Electroline Steel Rodding Equipment feeds easily around the bends.*

*Below, Leader locked in Pick-up for either push or pull.*



. PATENT APPLIED FOR

Utilities have found that one gang, with Electroline Steel Duct-Rodding Equipment, can make a half-hour job out of one that formerly took two gangs two weeks with old-style equipment!

In consequence, they have made amazing savings in labor cost alone. Add to this lower first cost, the lower handling cost, and longer life . . . then you have their reason for adopting Electroline's speedy, economical Duct-Rodding Equipment.

The construction is simple and trouble-free, yet affords the outstanding advantages of easy, efficient rodding and great durability in service.

Originated by Electroline—Always Ahead of the Field. Write for bulletins.

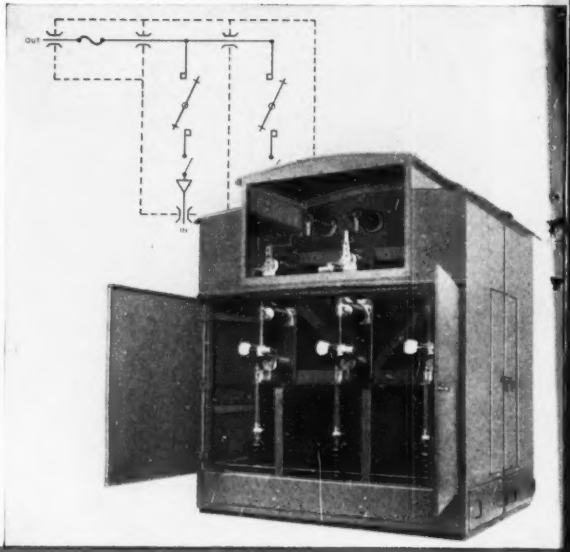
**Electroline Company**

**4121 South La Salle Street**
**Chicago 9, Illinois**

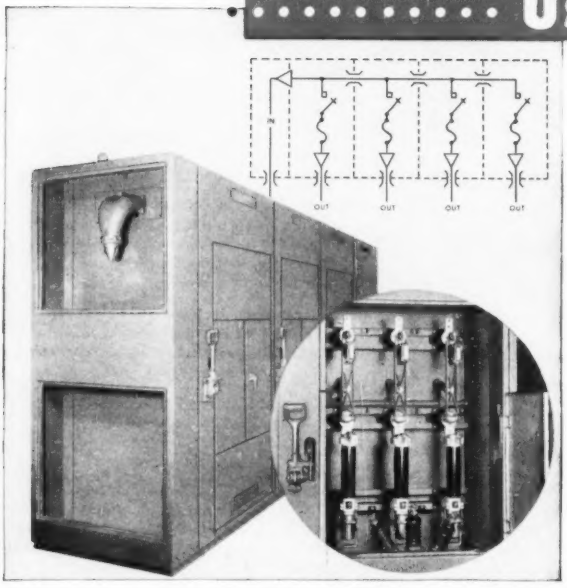
OTHER Electroline PRODUCTS

# WHERE HIGH VOLTAGE SWITCHGEAR MUST BE:

# RELIABLE
# ENCLOSED
# PACKAGED
## AND YET
# LOW IN COST



## USE S & C METAL-



Utilizing Alduti Interrupters and SM Power Fuses, S & C Metal-Enclosed Switchgear Units offer these important advantages:

● ***Large Savings in Equipment Costs*** as compared with circuit breakers, for Primary Switchgear, Secondary Switchgear, and Load Center Switchgear installations.

● ***Ease and Economy of Installation*** because all equipment within each unit—including meters, arresters, potheads, metering transformers, etc.—is factory assembled and connected. Incoming and outgoing connections are readily accessible.

**CODE**

Fuse — Disconnecting Switch

Lightning Arrester — Pothead

Meter — Through Bushing or wall opening

Potential Transformer

Current Transformer

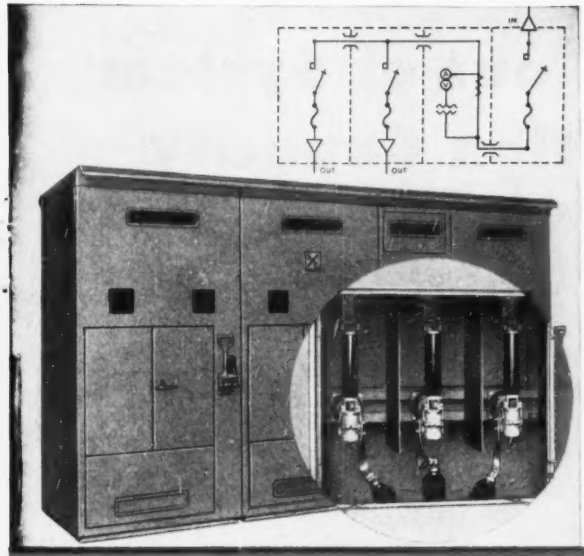
S & C Alduti Interrupter Switch

Above 15,000 volts

15,000 volts and below

**S & C ELECTRIC**

Formerly SCHWEITZER & CONRAD, INC.



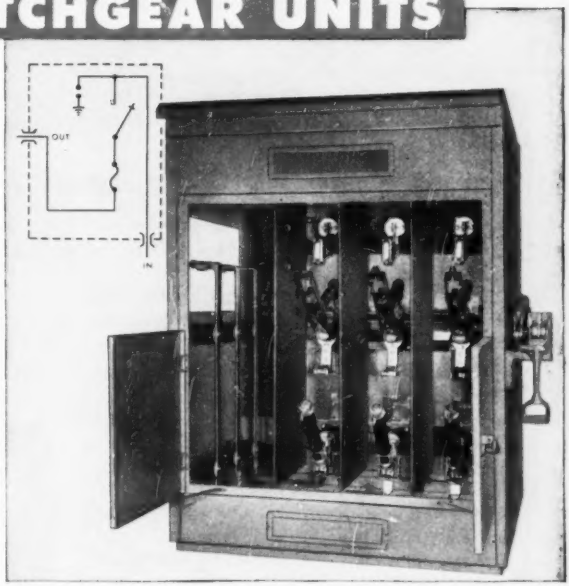

## Typical Performance Characteristics of S&C Metal-Enclosed Switchgear Units:

- ***Load Current Switching***...up to 600 amperes on 2,300- to 33,000-volt circuits.
- ***Magnetizing Current Switching***... of transformer banks whose load currents are within the continuous current ratings of the switches, that is, to 1200 amperes on 2,300- to 13,800-volt circuits and 600 amperes above 13,800- to 33,000-volt circuits.
- ***Charging Current Switching***... of three phase capacitor banks of 2,000 kvar on 2,300-volt circuits; and 3,000 kvar on 4,160- through 13,800-volt circuits.
- ***Short Circuit Protection***... to 40,000 amperes, rms asymmetrical, on 2,300- and 4,160-volt circuits; 30,000 amperes on 13,800-volt circuits; and 20,000 amperes on 33,000-volt circuits. Or, stated in symmetrical 3-phase kva: 104,000; 180,000; 448,000; and 715,000 respectively. For higher short circuit interrupting ability, consult the factory.

# ENCLOSED SWITCHGEAR UNITS

- ***Minimum Maintenance Expense*** since a blown fuse is fully restored by simple field replacement of its refill unit. Also, in the average application, the switches require just ordinary switch maintenance.

Shown here are typical units from regular production. Any special design can be made to meet your specific requirements. To get this modern, reliable, money-saving switchgear for your next installation—consult the telephone directory for the S&C representative in your city, or write us direct.

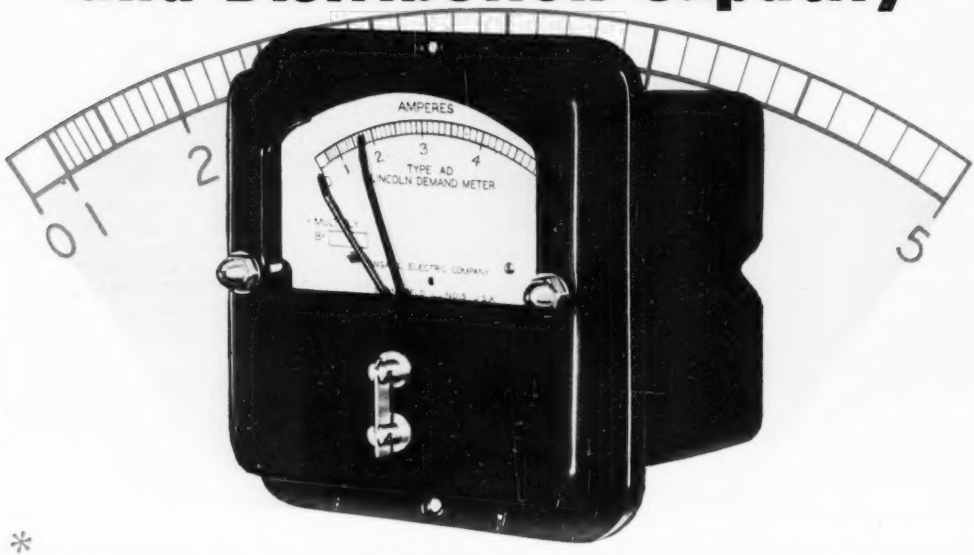



# COMPANY

4421 Ravenswood Avenue
Chicago 40, Illinois, U. S. A.

In Canada, Powerlite Devices, Limited, Toronto

# Get the Most out of System and Distribution Capacity*




*

## LINCOLN Type AD-2 Thermal Ampere Demand Meters

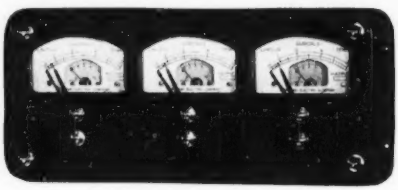
### measure the factor which determines the capacity of Substation Feeders

Lincoln Type AD-2 Meters are particularly useful in balancing the load between phases on feeder lines to help you get the most out of system and distribution capacity.

These meters are designed for either semi-flush or surface mounting on electric power switchboards, and are equipped with two demand indicating pointers. One pointer is attached to the actuating element of the meter and continually shows the demand on the feeder phase. The second pointer indicates the maximum demand by remaining at the highest point established since the last manual resetting.

Lincoln Type AD-2 Meters are available with either 3, 5, or 6 ampere full scale ratings. They can be supplied with an instantaneous indicator to immediately show if the load has been picked up after the feeder switch is closed.

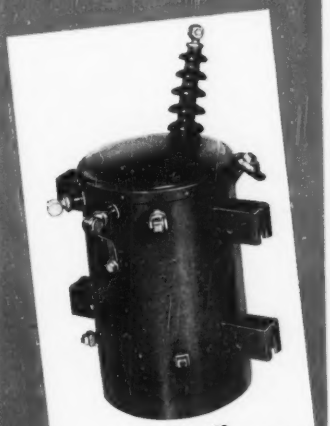
Complete information is given in Bulletin 462. Write for your copy.



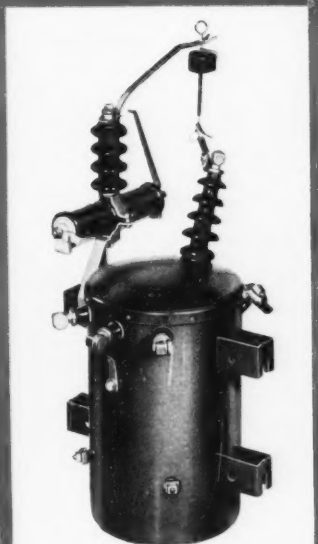
**Type AD-2 Meters are also available in triplex form in either horizontal or vertical design.**

50TH ANNIVERSARY SANGAMO 1899 - 1949

**SANGAMO**
**ELECTRIC COMPANY**
**SPRINGFIELD, ILLINOIS**



CAT. NO. 5T2
CONVENTIONAL SINGLE BUSHING



CAT. NO. 7T2
PROTECTED SINGLE BUSHING

CAT. NO. 6T2
CONVENTIONAL DOUBLE BUSHING

# 14.4 MERS

FOR
## 25 KV
DISTRIBUTION

24,900 GR "Y" / 14,400 VOLTS WITH
4 2½% **FULL CAPACITY** TAPS
(14,040, 13,680, 13,320 AND 12,960)

WITH
## 25 KV
INSULATION CLASS

150,000 VOLT MINIMUM IMPULSE LEVEL
ON PRIMARY PHASE ($H_1$) BUSHINGS ON **ALL 14.4mers** — AND ON **DOUBLE BUSHING 14.4mers,** THE PRIMARY NEUTRAL ($H_2$) BUSHINGS HAVE 95,000 VOLT MINIMUM IMPULSE LEVEL

GUARANTEE

**All RURALFORMERS including 14.4mers carry the same GUARANTEE which is 5 Years' SATISFACTORY SERVICE free from defective workmanship and materials and in addition PROTECTED TYPES carry a 1 year's guarantee for ANY SERVICE — excepting only mishandling.**

NOW PRICED TO BE
## ECONOMICALLY FEASIBLE

FOR EXAMPLE: GROUP PURCHASE PRICES
5 KVA'S AS PICTURED

| | EASTERN ZONE | WESTERN ZONE |
|---|---|---|
| 5T2 . . . | 136.00 | 139.00 |
| 6T2 . . . | 140.00 | 143.00 |
| 7T2 . . . | 171.00 | 174.00 |

WRITE FOR 14.4MER BULLETIN WHICH INCLUDES PRICES

RURALFORMER

# RURAL transformer & equipment co.

MILWAUKEE WISCONSIN

# PROOF that you get

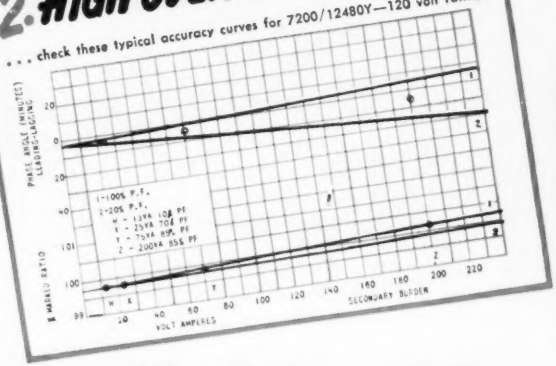
## 1. HIGH THERMAL CAPACITY

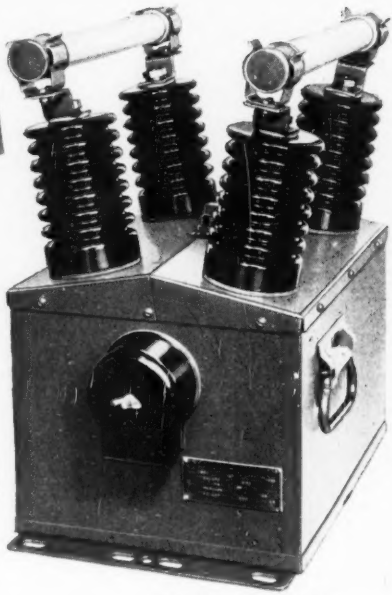
. . . thermally capable of supplying several times nominal rating continuously!

| Voltage | Nominal Rating | Thermal Capacity |
|---|---|---|
| 240 to 2400 | 200 VA | 500 VA |
| 4800 to 7200 (line to line) | 200 VA | 600 VA |
| 7200 (line to neutral) to 14,400 v. | 200 VA | 1000 VA |

## 2. HIGH OVERALL ACCURACY

. . . check these typical accuracy curves for 7200/12480Y—120 volt rating.



## with Allis-Chalmers Indoor Potential Transformers

Type PD potential transformer with current limiting fuses, rated 14400 — 120 volts.

Unit at left is rated 14400 — 12 volts; unfused.

Rating of PD transformer at right is 2400 — 120 volts; unfused.

RESERVE THERMAL CAPACITY and uniformly low phase angle and ratio errors are among the first qualities you demand in potential transformers.

They're qualities you GET when you specify Allis-Chalmers type PD's!

One of the reasons is A-C's "balanced design." Materials are distributed in such a manner as to obtain closely balanced characteristics over the entire operating range. This, plus built-in high thermal capacity makes type PD transformers ideal for heavy duty, accurate metering service.

Proof of these claims is offered in the charts above.

For complete information on design, construction and mounting features, contact your nearby A-C sales representative.

Or write direct for new Instrument Transformer bulletin 61B7168, listing over 400 types and ratings. A-2808

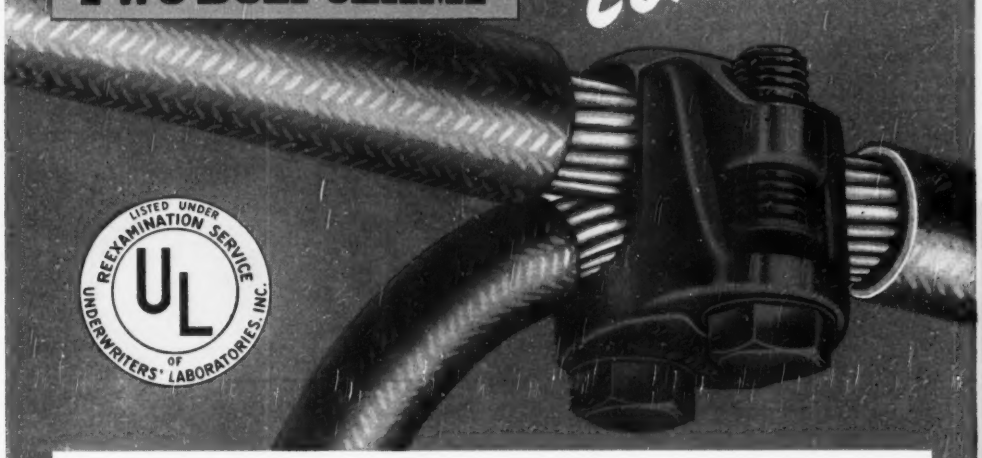
ALLIS-CHALMERS, 932A SO. 70 ST.
MILWAUKEE, WIS.

# ALLIS-CHALMERS

*Pioneers in Power and Electrical Equipment from Generation through Utilization*

# BLACKBURN
## *Hi-Strength*
## TWO-BOLT CLAMP

ECONOMICAL! EFFICIENT! COMPACT!




## A BETTER CABLE CONNECTOR AT LESS COST!

- Especially designed for medium and large stranded wire and cable.
- Produces very high clamping pressure resulting in low resistance joints on stranded wire.
- It costs much less than other types of connectors commonly used.
- It is excellent for dead ends, taps, and service entrance connections and will accommodate a range of wire sizes.
- Exclusive helical serrations in both body and cap, conforming to the lay of stranded wire, together with the high clamping pressure produce a joint which will not pull apart. Thus the Blackburn Two-Bolt CLAMP is excellent for dead ending.
- It's made of high strength alloys throughout. Its extra strength maintains the high "pressure between wires" indefinitely. Thus it makes a lasting, trouble-free connection.
- It's compact and easy to tape — makes a neat joint.
- It's simple and easy to install.
- Made in sizes 1/0 to 1000 MCM.

**Jasper Blackburn Products Corp.**

*Builders of Quality Connectors for 15 Years*

FIRST, MADISON AND CLINTON STS. • ST. LOUIS 6, MO.
Phone CEntral 3007

**Mail Coupon for Sample and Full Details**

Send me sample and further information on the BLACKBURN TWO-BOLT CLAMP.

Wire Size Used _____

Your Name _____

Company _____

City & State _____ EW

# Which of these 7

## WILL GIVE YOU BEST ELECTRICAL CABLE

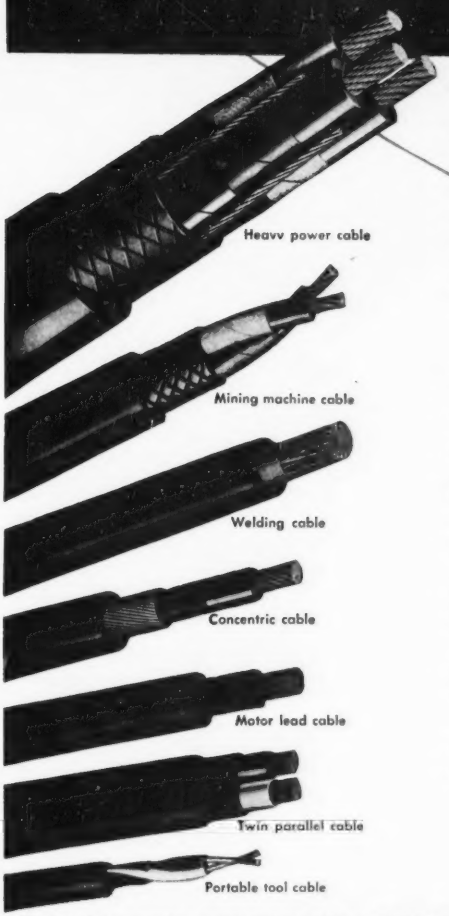
| PROPERTIES AND TESTS | | REPRESENTATIVE TEST VALUES FOR VARIOUS COMPOUNDS | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | AMARINE —40 | AMERZONE —0 | AMERZONE —B | AMARINE —RWS | AMERITE | AMPEROX | AMERPRENE |
| BASIC TYPE OF INSULATION | | Natural Rubber | Oil-base | Butyl Rubber | Synthetic Rubber | Commercial 30% | Heat-Resistant | Polychloroprene |
| MAX. REC. COPPER TEMP. | | 60°C | 75°C | 80°C | 75°C | 60°C | 75°C | 80°C |
| ELECTRICAL CHARACTERISTICS | Dielectric Constant (Spec. Ind. Cap.) | 4.0 | 4.0 | 4.0 | 4.5 | 4.5 | 4.5 | .... |
| | Ins. Res. (K) | 50,000 | 7,500 | 40,000 | 30,000 | 30,000 | 20,000 | 100 |
| | Dielec. strength in volts per mil | 450 | 350 | 300 | 400 | 400 | 350 | 200 |
| PHYSICAL PROPERTIES | Tensile Strength in lbs. per sq. in. | 2000 | 600 | 700 | 950 | 1000 Synth. 1500 Nat. | 1000 Synth. 1800 Nat. | 2000 |
| | Elongation in 2" | 450% | 300% | 400% | 450% | 500% | 500% | 500% |
| | Permanent set | ¼" | ½" | ⅜" | ⅜" | ¼" | ¼" | ¼" |
| ACCELERATED AGING | Type of test | Geer Oven | Geer Oven | Geer Oven | Oxygen Bomb | Geer Oven | Oxygen Bomb | Geer Oven |
| | Temperature | 70°C | 80°C | 100°C | 80°C | 70°C | 80°C | 80°C |
| | Hours | 288 | 168 | 672 | 168 | 504 | 336 | 168 |
| | % Original Tensile Strength | 70% | 80% | 80% | 80% | 85% | 80% | 90% |
| MOISTURE RESISTANCE | Gain in wt. after 7 days immersion at 70°C (Mg. per sq. in.) | 25 | .... | 20 or less | 15 or less | 35 | 35 | 30-60 |
| | Capacity increase after 4 weeks immersion at room temperature | 15% | 15% | 15% | 10% | 15% | 15% | .... |
| | Stability Factor 40-80 volts per mil 2 weeks at 50°C | .5% | 1.5% | 1.0% | .8% | 2.0% | 3.5% | .... |
| SPECIAL PROPERTIES | | High Voltage and Submarine use | Meets IPCEA ozone test | Withstands .03 conc. 10 hours | For hot and moist locations | General purpose rubber insulation | General purpose rubber insulation | Resistant to oil, flame and ozone |

As the test data vary considerably with different sizes of conductor and thicknesses of insulation, these identical results can not be guaranteed throughout the whole range of sizes and voltage ratings. Some specific constructions will test higher and others will test lower than the listed values. However, the above table indicates in general what may be expected of these compounds.

**AMERICAN STEEL & WIRE COMPANY**

# rubber compounds

## PERFORMANCE AT THE LEAST COST?




THE proper selection of rubber compounds for electrical cable may mean the difference between long satisfactory service or frequent and costly shut-downs for repairs.

Some rubber compounds will stand more heat tnan others. Some can be used underground—others can't. The point to remember is this —*no one or two rubber compounds will meet all the conditions encountered in electrical cable operation.* That's why engineers and chemists at American Steel and Wire Company have perfected a wide variety of rubber compounds for different cable applications.

The right combination of compounds will assure better service from electrical cables at lower cost to you.

### A GUIDE TO SELECT RUBBER COMPOUNDS

| | SPECIFY |
|---|---|
| FOR UNDERGROUND OR UNDER WATER SERVICE—at high voltages, for all submarine power cables and for general use above 7,500 volts— | AMARINE—40 |
| FOR OZONE-RESISTANCE—Amerzone-0 is an excellent oil-base compound. Amerzone-B is a butyl rubber compound that is highly resistant to heat and moisture as well as ozone. | AMERZONE |
| HOT OR DAMP LOCATIONS—Select a compound with high moisture resistance and high heat resistance. | AMARINE—RWS |
| GENERAL USE—For voltages up to 7,500 where copper temperatures do not exceed 60°C (140°F.), a performance type compound is satisfactory. | AMERITE |
| GENERAL USE with HEAT RESISTANCE—For voltages to 7,500 and where copper temperatures may run up to 75°C. (167°F.). | AMPEROX |
| FLEXIBLE JACKETS—Where resistance to oil, flame and sunlight is desired a compound containing Neoprene is recommended. | AMERPRENE |

AMERICAN STEEL & WIRE COMPANY, GENERAL OFFICES: CLEVELAND, OHIO
COLUMBIA STEEL COMPANY, SAN FRANCISCO, PACIFIC COAST DISTRIBUTORS
TENNESSEE COAL, IRON & RAILROAD COMPANY, BIRMINGHAM, SOUTHERN DISTRIBUTORS
UNITED STATES STEEL EXPORT COMPANY, NEW YORK

Standard cable construction or special designs of cable are available from American Steel and Wire Company. We make the cable fit the job. This policy assures the longest cable life at lowest cost to the user.

USS

# AMERCLAD CABLES

UNITED STATES STEEL

**fewer replacements**
**+**
**less maintenance**
**+**
**maximum performance**

**= a MUST in your planning**

**LAPP LINE POST**

INSULATOR failures cost you: unit replacement + maintenance labor + possible loss of revenue through outage + strained consumer relations. Actual PERFORMANCE records of installations over the past eighteen years show *in every case* that *lines on Lapp Line Posts have fewer outages, require fewer replacements and less maintenance than comparable lines on any other type of insulator.* Rugged punishment-takers, Lapp Line Posts have a *proved record* of only 1% to 10% the replacement rate on pin type insulators, because:

- If severe flashover or rifle attack breaks off a petticoat or two, the body itself does not crack; leakage and flashover distance are lowered only negligibly. *The insulator remains in fully effective service!* (Contrast with the fragility of shell-type insulators, and the fact that loss of a single shell costs 35% or more of their electrical characteristics.)
- Rugged one-piece construction makes it *impossible* for Lapp Line Posts to crack under tension caused by relative thermal movement—a common reason for failure in multi-part insulators.
- Lapp Line Posts are self-cleaning, eliminating maintenance, increasing efficiency.

For dependable service, punishment-absorbing durability, maximum PERFORMANCE—all adding up to economy—no other insulator can match the *proved* record of Lapp Line Posts. Put them to work for you. They'll be yours for life.

***PERFORMANCE IS PROOF***

# Lapp INSULATORS

# No "SQUATTERS" Allowed

## *INSIDE YOUR DIESEL CRANKCASE!*

**NEWEST GARGOYLE OILS**

**keep incomplete combustion particles and oxidation products on the move...bearings and oil passageways free of sludge.**

★ ★

**For CONTINUOUS POWER—Rely on the BEST!**

Here's a spot inside high-output Diesels where you're likely to have unwelcome settlers. That oil shown draining down from the cylinders brings with it contaminating materials that tend to settle on the crankcase surfaces and oil passageways. Now Socony-Vacuum has licked this problem. The latest Gargoyle Oils for Diesels are designed to keep these materials dispersed, so they can't collect on vital parts or clog passageways. Your crankcase—as well as your cylinder walls and pistons—*stay clean.*

SOCONY-VACUUM

GARGOYLE Lubricants

SOCONY-VACUUM OIL CO., INC.
and Affiliates: MAGNOLIA PETROLEUM CO.
GENERAL PETROLEUM CORPORATION

*Rely on* **SOCONY-VACUUM**
*Correct Lubrication*

# POWERS GENERAL SERVICE BODIES

The versatility of these POWERS Bodies permits them to be used for gas, telephone, water and electric service; street light maintenance, and other types of general service work. Large, weather-tight compartments are fitted with shelves, parts bins, and material hooks to provide facilities for the tools, supplies, and equipment required on almost any job. Standard models are available for installation on ½, ¾, and 1 ton chassis.

POWERS Bodies are also available for construction, maintenance, and service operations in all phases of the public utility industry. Write for complete information.

SERIES 700-C — Forestry Body. Crew compartment comfortably accommodates four men. Winch and derrick optional.

AD-10—Pole Dinkey. Has 1 ton capacity. Other models having capacities up to 5 ton are also available.

SERIES 500 — Line Construction and Maintenance Body. Various models are available for all standard truck chassis.

ALL-STEEL POWERS Public Utility Bodies

UTILITY BODY DIVISION
McCABE-POWERS AUTO BODY CO.
5900 N. BROADWAY • ST. LOUIS 15, MO.

WITH

# DIEFLEX

VARNISHED TUBING PRODUCTS

**SURE,** you have to put on the heat for greater productivity with today's more competitive market.

But, you don't have to work harder to turn out more goods—not when you let Dieflex Varnished Tubing Products take the extra load . . . and Dieflex will! The secret lies in easier handling, greater flexibility, non-fraying ends. No time is wasted struggling with hard-to-assemble pieces; slow-down causes are eliminated, production is greater . . . with no increase in effort! And the smooth inside bore of Dieflex prevents snagging, guarantees a rapid, even flow of production.

Arrange now to get test-run samples and prove to your own satisfaction that Dieflex increases production. Contact your nearest Dieflex sales office, today.

## DIEFLEX PRODUCTS LIST

**MADE WITH BRAIDED COTTON SLEEVING BASE**

Grade A-1 Magneto Grade Varnished Tubings
Grade B-1 Standard Grade Varnished Tubings
Grades C-1 and C-2 Heavily Coated Saturated Sleevings
Grade C-3 Lightly Coated Saturated Sleevings
Heavy Wall Varnished Tubings and Saturated Sleevings

**MADE WITH BRAIDED GLASS SLEEVING BASE**

Grade A-1 Magneto Grade Varnished Glass Tubings
Grade C-1 Extra Heavily Saturated Glass Sleevings
Grade C-2 Heavily Saturated Glass Sleevings
Grade C-3 Lightly Saturated Glass Sleevings
Silicone-Treated Glass Varnished Tubings and Sleevings

## FREE TECHNICAL LITERATURE

Send for your free copy of the Dieflex technical folder which describes the different types and grades of Dieflex Varnished Tubings and Saturated Sleevings. Easy-to-read charts help you to select the right tubing or sleeving for your particular application.

# INSULATION MANUFACTURERS CORPORATION

Chicago 6 • 565 W. Washington Blvd.

MILWAUKEE 2
312 E. Wisconsin Ave.

CLEVELAND 14
1231 Superior Ave., N. E.

DETROIT 2
15 Lawrence Ave.

DAYTON 2
120 W. Second St.

*IMC Representatives*
W. C. JOHNSON—PEORIA 5—101 Heinz Court
H. A. HOLDEN—MINNEAPOLIS 3—1208 Harmon Place
H. R. BRETHEN—DETROIT 2—15 Lawrence Ave.

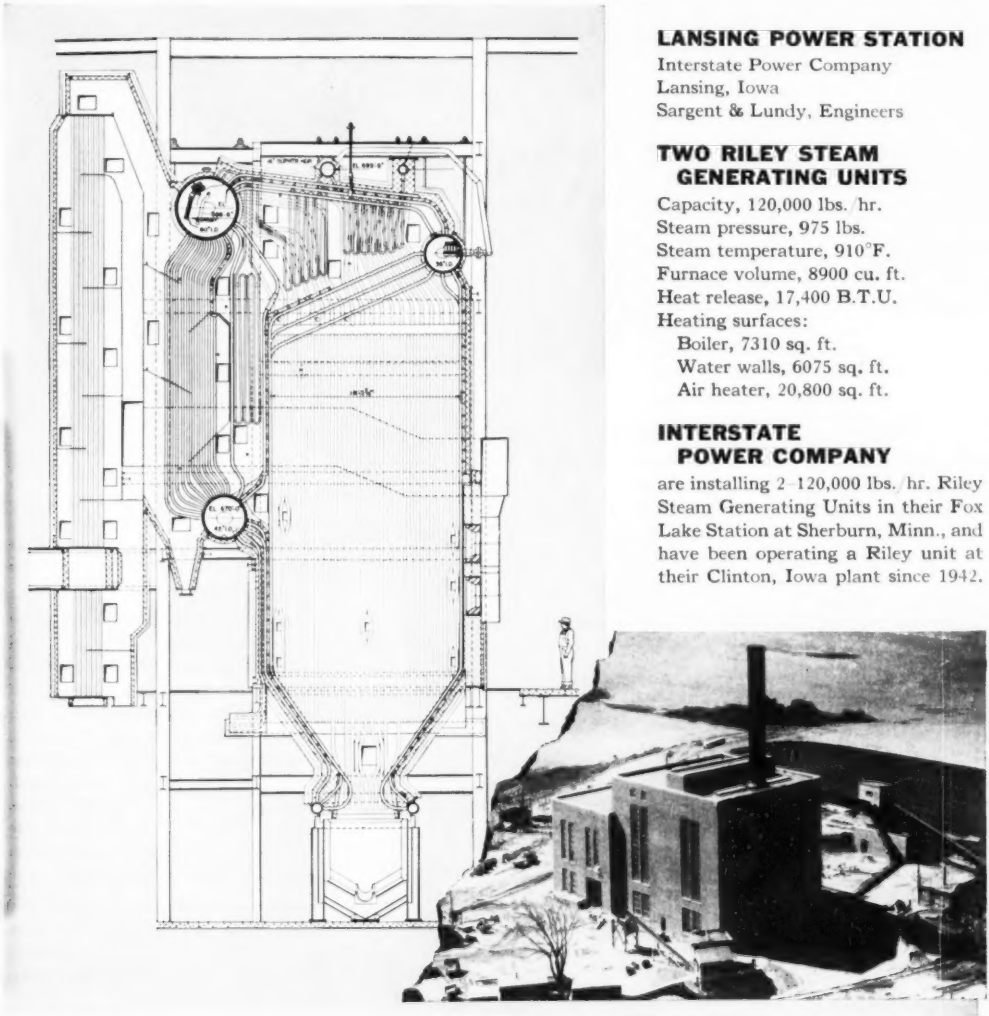
*Authorized Distributors*
INSULATION and WIRES INCORPORATED
St. Louis 3, Mo. • Atlanta, Ga. • Boston 20, Mass.
Detroit 2, Mich. • Houston 2, Tex. • Hillside, N. J.
and other cities.

TRI-STATE SUPPLY CORPORATIONS
Los Angeles 13, Cal. • San Francisco 7, Cal. • Seattle 4, Wash.

SUFLEX CORPORATION
33-11—57th St., Woodside, N. Y.

ELECTRICAL IMC INSULATION

# At Interstate Power, actual results from their



**LANSING POWER STATION**
Interstate Power Company
Lansing, Iowa
Sargent & Lundy, Engineers

**TWO RILEY STEAM GENERATING UNITS**
Capacity, 120,000 lbs. /hr.
Steam pressure, 975 lbs.
Steam temperature, 910°F.
Furnace volume, 8900 cu. ft.
Heat release, 17,400 B.T.U.
Heating surfaces:
Boiler, 7310 sq. ft.
Water walls, 6075 sq. ft.
Air heater, 20,800 sq. ft.

**INTERSTATE POWER COMPANY**
are installing 2–120,000 lbs. /hr. Riley Steam Generating Units in their Fox Lake Station at Sherburn, Minn., and have been operating a Riley unit at their Clinton, Iowa plant since 1942.

TRADE MARK Rx REGISTERED

**RILEY**

**STOKER CORPORATION, WORCESTER, MASS.**

Boston Cincinnati New York Atlanta Philadelphia New Orleans Denver Washington Memphis Salt Lake City Buffalo St. Louis Los Angeles Pittsburgh Kansas City Portland Cleveland St. Paul Seattle Detroit Tulsa Chicago Houston

BOILERS • PULVERIZERS • BURNERS • STOKERS • SUPERHEATERS • FLUE GAS SCRUBBERS

# Riley Units exceed guaranteed performance

Progress of the Riley Stoker Corporation in the boiler industry—1948 was the biggest year in Riley history—can be attributed not only to the quality and outstanding performance of Riley equipment but also to the gratifying manner in which Riley handles the entire contract. Users of Riley products know that Riley gives their customers their money's worth and that you can rely on Riley to furnish units which will give entire satisfaction.

Compare actual performance with guarantees at the Lansing Power Station of Interstate Power Company. Note that exit gas temperatures are 13 degrees better than guaranteed, that efficiency is higher and draft and air pressure losses lower. Such performance is typical of what you can expect when you install Riley units.

## Comparison of Actual and Guaranteed Performance

| | Actual Results | Guaranteed Results |
|---|---|---|
| Steam output | 122,272 lbs. hr. | 120,000 lbs./hr. |
| Gas temperature | | |
| Leaving boiler | 736°F. | 765°F. |
| Leaving air heater | 362°F. | 375°F. |
| Air temperatures | | |
| Entering air heater | 107°F. | 100°F. |
| Leaving air heater | 604°F. | 600°F. |
| Steam temperature | 910°F. | 910°F. |
| Draft loss | 4.88" | 5.40" |
| Air pressure required | 5.90" | 6.50" |
| Heat balance | | |
| Efficiency | 84.56 | 84.00 |
| Losses | | |
| Dry chimney gas | 6.13 | 6.62 |
| Hyd. and moisture in fuel | 5.83 | 5.83 |
| Moisture in air | .15 | .15 |
| Unburned combustible | .53 | 1.30 |
| Ash pit water | .23 | — |
| Radiation, unaccounted for and leeway | 2.59 | 2.10 |
| | 100.00 | 100.00 |

## Investigate results from some of these recent Riley installations

**Northern Virginia Power Co.**
Riverton Station, Winchester, Va.

**Central Illinois Light Co.**
R. S. Wallace Station, E. Peoria, Ill.

**Arkansas Power & Light Co.**
Cecil Lynch Station, Little Rock, Ark.

**South Carolina Power Co.**
Hagood Station, Charleston, S. C.

**New Orleans Public Service Co.**
Market St. Station, New Orleans, La.

**Ohio Edison Co.**
Mad River Station, Springfield, Ohio

**Mississippi Power Co.**
Plant Eaton, Hattiesburg, Miss.

**Iowa-Illinois Gas & Electric Co.**
Riverside Station, Davenport, Iowa

**Coralville Station**
Iowa City, Iowa

**Public Service Co. of Indiana**
Dresser Station, Terre Haute, Ind.
Edwardsport Station, Edwardsport, Ind.
Noblesville Station, Noblesville, Ind.

**Gulf Power Co.**
Pensacola Steam Station, Fla.

**Houston Lighting & Power Co.**
West Junction Station, Houston, Texas
Greens Bayou Station, Houston, Texas
Gable Street Station, Houston, Texas

**Central Ohio Light & Power Co.**
Woodcock Station, Bluffton, Ohio

**Otter Tail Power Co.**
Kidder Station, Wahpeton, N. D.
Crookston Station, Crookston, Minn.
Devils Lake Station, Devils Lake, N. D.
Canby Station, Canby, Minn.
Hoot Lake Station, Hoot Lake, Minn.

**Southwestern Public Service Co.**
Borger, Texas

**Pennsylvania Electric Co.**
Williamsburg, Pa.

**Utah Power & Light Co.**
Orem Station, Provo, Utah
Jordan Station, Salt Lake City, Utah

**Worcester County Electric Co.**
Webster St. Station, Worcester, Mass.

**West Penn Power Co.**
Milesburg Station, Milesburg, Pa.

**Lynn Gas & Electric Co.**
Lynn, Mass.

*A survey of your Power Plant by a consulting engineer will possibly show ways of making surprisingly large savings in your power costs*

# COMPLETE STEAM GENERATING UNITS

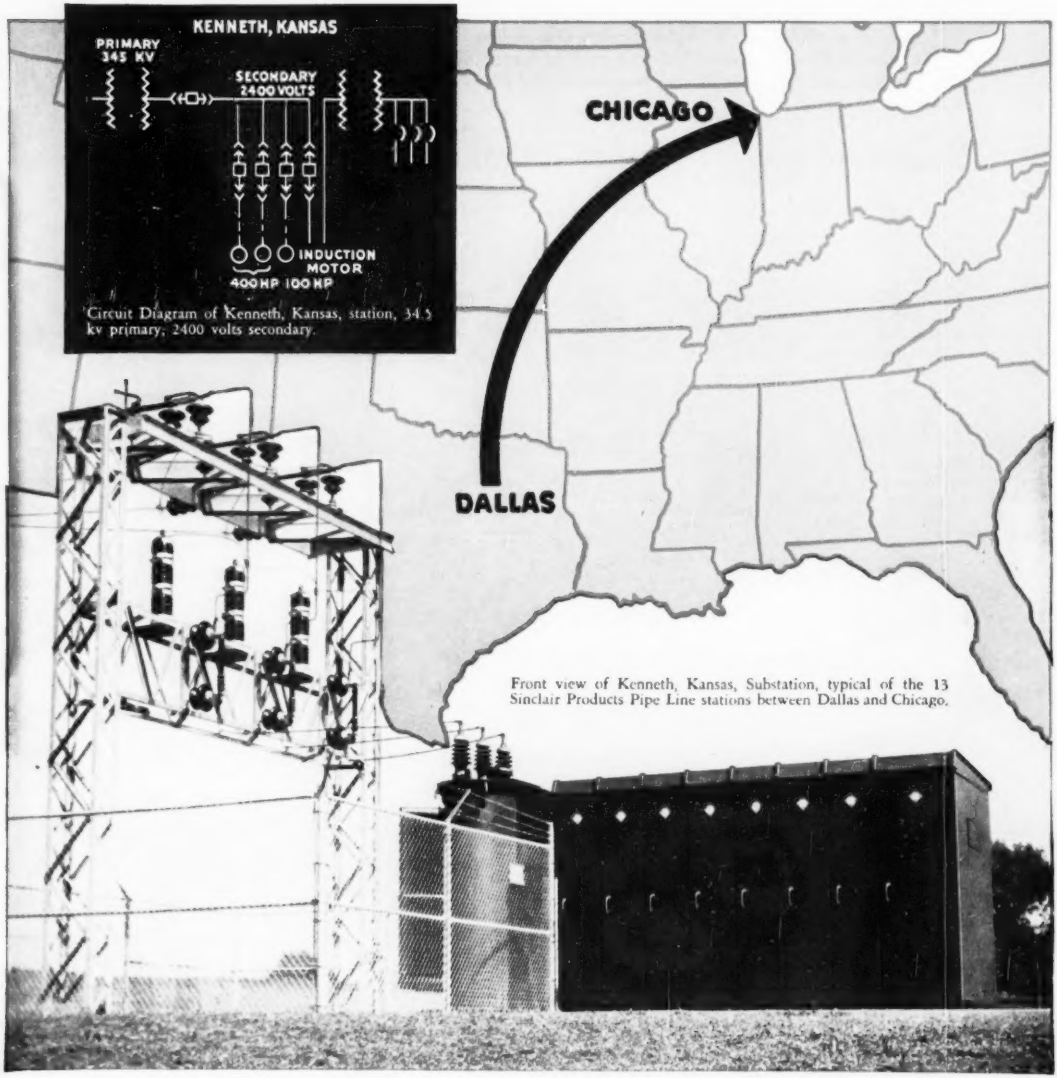
. . . it will pay you to visit modern Riley Installations before purchasing Boiler or Fuel Burning Equipment

ECONOMIZERS • WATER-COOLED FURNACES • STEEL-CLAD INSULATED SETTINGS • AIR HEATERS

# ALLIS-CHALMERS
# Sinclair Pipe Line




Circuit Diagram of Kenneth, Kansas, station, 34.5 kv primary, 2400 volts secondary.




Front view of Kenneth, Kansas, Substation, typical of the 13 Sinclair Products Pipe Line stations between Dallas and Chicago.

# Switchgear Protects from Dallas to Chicago

## *45 Outdoor Switchgear Units with Ruptair Circuit Breakers and 28 Type "H" Auxiliary Units Provide Power Protection On the Sinclair All-Electrified Products Pipe Line*

View of Control House and Substation at Kenneth, Kan.

FINISHED petroleum products flow north and east from Texas refineries to Illinois in the all-electrified Sinclair Refining Company Products pipe line. Electric power for the entire system is protected by Allis-Chalmers switchgear.

Through this unusual transportation line, many different grades of petroleum products flow simultaneously at approximately 4 m.p.h. Precise timing, possible through continuous electric power and precision-timed clocks, permits drawing off any petroleum product at each of the 13 stations. Reversal of pumping power reverses the flow of petroleum products.

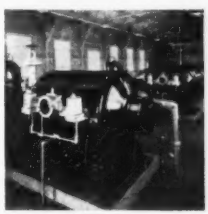
Any power failure on the 1500 mile pipe line means loss of timing and slackening of petroleum supply. Reliable, standardized Allis-Chalmers switchgear units stand guard to protect power supply and equipment.

These Allis-Chalmers switchgear units are equipped with 50 mva interrupting capacity, *Ruptair* circuit breakers, thermal overload and undervoltage relays. Switchgear and Allis-Chalmers OISC transformers form unit substations that provide remote control starting and stopping of motor driven pumps.

All steel-enclosed outdoor housings are completely weather proof. Each unit is operationally safe and complete with interlocks and grounded, all-steel compartments. Standard design of the prefabricated units means that a pipe line operator familiar with one station would be familiar with all of them.

* * *

For better control and protection of electrical equipment, utilities and industries are turning to Allis-Chalmers switchgear. It provides the sure answer to their power protection problems.



400 HP 3600 RPM AZZ motors installed at the Arlington Station of Sinclair's Products Pipe Line.

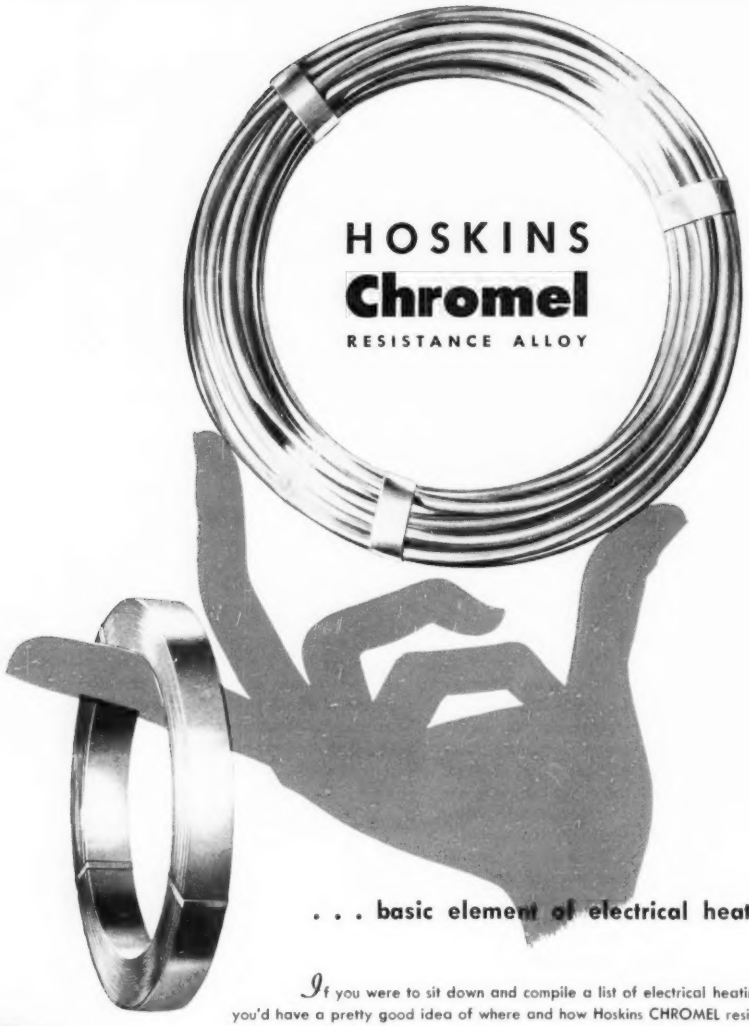
Allis-Chalmers switchgear is prefabricated, easy to install, safety-engineered. It is delivered ready to operate, complete with mechanically trip-free breakers. These features and others give you the most economical power protection. Call your nearby Allis-Chalmers Sales office or write direct. *Ruptair* is an Allis-Chalmers trademark.

A-2813

ALLIS-CHALMERS, 932A SO. 70 ST.
MILWAUKEE, WIS.

# ALLIS-CHALMERS

***First in the U.S. with Metal-Clad Switchgear***




## . . . basic element of electrical heating

If you were to sit down and compile a list of electrical heating applications, you'd have a pretty good idea of where and how Hoskins CHROMEL resistance alloy is used. For CHROMEL, you know, is the *original* nickel-chromium alloy that *first* made electrical heating practical. It's ductile, durable stuff . . . easy to work with, hard to burn out. Possesses close-to-constant "hot" resistance between 700° and 2000° F. Delivers full-rated power throughout its long and useful life. And, for over 40 years, it's been used consistently and with confidence by leading manufacturers of all types of electrical resistance heating devices. So if you're concerned with electrical heating . . . from a utility load building point of view, as a manufacturer of appliances, or as a user of electric heat in your manufacturing processes . . . your best interests can best be served by Hoskins CHROMEL wire, ribbon or rod. Our Catalog M-1 contains complete technical information . . . want a copy?

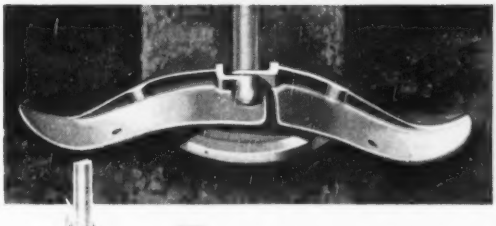
**HOSKINS MANUFACTURING COMPANY**
4445 LAWTON AVE. • DETROIT 8, MICHIGAN

**Heating Element Alloys ★ Heat Resistant Alloys ★ Thermocouple Alloys ★ Spark Plug Electrode Wire ★ Special Alloys of Nickel ★ Electric Heat Treating and Laboratory Furnaces**

Chromel® nickel-chromium wire

# KEARNEY

## Anchors, Guy Guards and Guy Wire Clips



*for More Efficient Guying Operations*

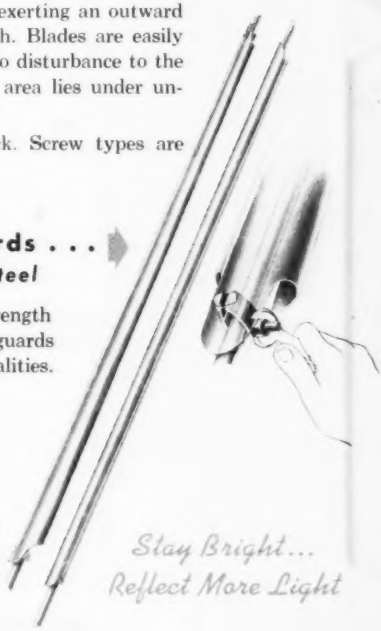
This certified malleable iron expansion anchor with special blade contour gives you additional holding power by exerting an outward as well as an upward pressure against the earth. Blades are easily tamped into position with a tamping bar with no disturbance to the earth and when fully expanded, 63% of blade area lies under undisturbed earth.

These anchors can now be shipped from stock. Screw types are also available.

### KEARNEY ALUMINUM Full-Vu Guy Guards . . .

***Lighter in Weight, Equal in Strength to Galvanized Steel***

The aluminum alloy used in these guards was selected for its strength and ability to retain a bright finish. Non-corrosive, these guards are safer for the public because of their light-reflecting qualities. Available in all round tapered and half round.



*Stay Bright... Reflect More Light*

***Serve Up Strand Ends the Modern Way...***

### Use KEARNEY Guy Wire Clips

Requiring only one-fourth the time as was required by the use of waste strand, this method is less expensive and does the job better.

**JAMES R. KEARNEY CORPORATION**

**4224-42 Clayton Ave. • Saint Louis 10, Missouri**

*Canadian Plant • Guelph, Ontario*

*Always Specify* JAMES R. KEARNEY CORPORATION ST. LOUIS, MO. *for the Job...*

-140

**Better Construction – *SAFER* Maintenance**

**TODAY'S CHANGING OPERATING CONDITIONS**

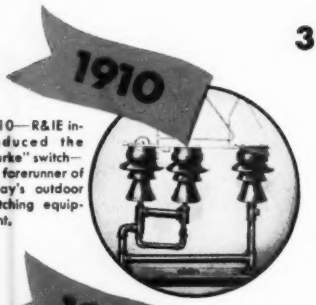
**GREATER LOADS**

**HEAVIER FAULT CURRENTS**

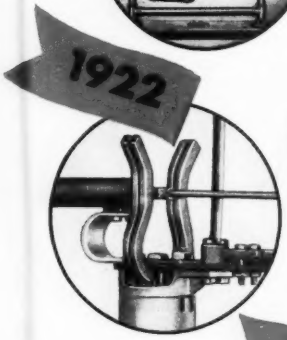
**INCREASED ATMOSPHERIC CONTAMINATION**

**A**

# 39 YEARS OF SWITCH DEVELOPMENT PRODUCES THE "SWITCH OF TOMORROW"




1910—R&IE introduced the "Burke" switch—the forerunner of today's outdoor switching equipment.




1922—R&IE introduced the Hi-Pressure contact, an important improvement in switch design.

34.5 Kv.
600 Ampere

## CHECK the FACTS

**1 JAW CONTACT**—Hi-Pressure, Hi-Thermal capacity silver to copper contact. ONLY ONE BREAK CONTACT on the switch. Copper and beryllium jaw—copper for thermal capacity and beryllium for strength and resilience. Here's maximum protection against fault current damage.

**2 HINGE CONTACT**—Completely enclosed and weather sealed Hi-Pressure, Hi-Thermal capacity, silver to copper Hinge Contact. Continuous, annular, constant electrical and mechanical contact at all times. Eliminates second break contact with its multiplied problems and maintenance.

**3 BLADE OPERATING MECHANISM**—Simplified and "streamlined" to attain a simple harmonic, accurately controlled blade motion. Special pin fastenings, snap rings, and rivets have been eliminated from moving parts. Universal blade balance on 69 Kv. and above.

**4 BLADE**—Extra heavy, hard drawn tubular copper with integral, formed contact end. Solid current path from jaw to hinge contact.

**5 TERMINALS**—Four half-inch bolts on 1¾ x 1¾ inch centers permit NEMA standard 600 or 1200 Ampere clamping and R&IE Type "UC" universal clamps. Both terminals equal height from base.

**6 BEARING**—Aluminum housed, weather sealed, stainless ball—requires no lubrication.

Now available for delivery

I-T-E
R&IE

# NEW Frontier

FOR THE

# MODERN PIONEER

R&IE

34.5 Kv.
600 Ampere

The NEW TYPE **TTR-49**

**Before you buy any switch that gives you less**

•

**CHECK the FACTS on TTR-49**

**A new conception of switch value**

•

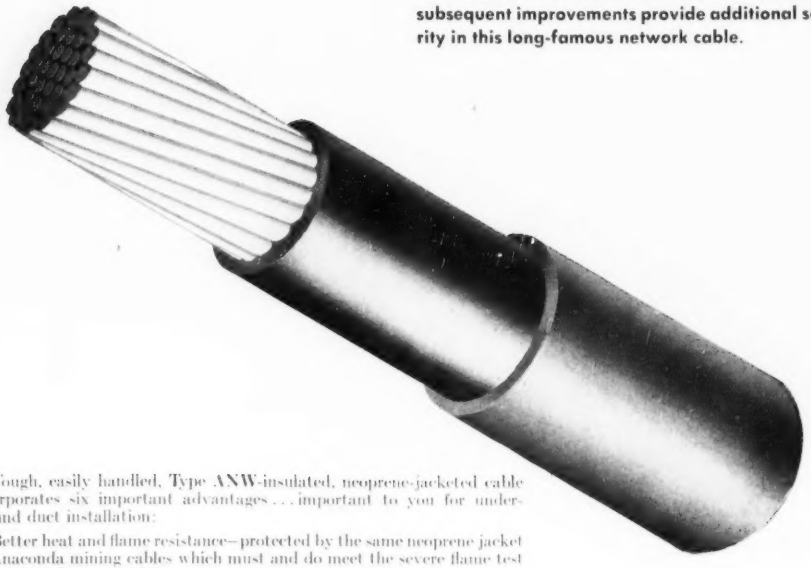
**RAILWAY and INDUSTRIAL ENGINEERING CO., GREENSBURG, PA.**

IN CANADA—EASTERN POWER DEVICES LIMITED, TORONTO
*An I-T-E ORGANIZATION*

# For Uninterrupted Service Under All Network Conditions

**ANW**
**(Anaconda Net Work)**

**Time-tested since 1932 under all service conditions, subsequent improvements provide additional security in this long-famous network cable.**



● Tough, easily handled, Type ANW-insulated, neoprene-jacketed cable incorporates six important advantages . . . important to you for underground duct installation:

**1.** Better heat and flame resistance—protected by the same neoprene jacket as Anaconda mining cables which must and do meet the severe flame test of the U.S. Bureau of Mines.

**2.** Higher resistance to duct acids and alkalies—years of experience with Type ANW insulation with only a braid covering showed it to be highly resistant to oils, acids and alkalies encountered in soil and sewage waters. NOW it has the additional protection of the neoprene jacket which itself has shown by test and experience, excellent resistance to these agents of destruction.

**3.** Higher operating temperature—now 75 C copper temperature, continuous duty.

**4.** Superior aging—Type ANW insulation has demonstrated year after year . . . and now even better . . . long-aging characteristics under severe oxygen bomb and air bomb tests.

**5.** Low moisture absorption—Type ANW insulation has always had low moisture absorption . . . far less than is detrimental to safe operation.

**6.** More easily handled—passes 180 degree cold-bend test at 0° C without damage to jacket. Cable is lighter, easier to pull. No lead to fuse, insulation and jacket do not support combustion.

ANACONDA

**ANACONDA WIRE & CABLE COMPANY**

**25 Broadway, New York 4, N. Y.**

# EXPERT, DEPENDABLE, CONVENIENT
# Motor Repair Service

**Typical Allis-Chalmers Certified Service Shop — Electric Apparatus Repair Company, Philadelphia— is equipped for big emergency jobs ...gives fast, personalized service on every day maintenance and repair.**

WHEREVER your plant is located — from Boston to San Diego — you can get prompt, skillful motor repair service from a nearby Allis-Chalmers Certified Service Shop. These shops, selected for their reliability and excellent repair facilities, now cover every major industrial area in the country.

When you need work done on motors, transformers or control — when you're looking for a shop that can help you cut lost production hours and get you rolling again, fast—call the A-C Certified Service shop nearest you.

These shops are hand-picked from the best independent shops in your locality. They meet exacting A-C standards — use factory-approved methods and parts to assure like-new motor performance.

## Need Repairs? New Motors?

For expert service — for new motors from ½ to 25,000 hp — give your nearest A-C Authorized Dealer or Sales Office a call!

A-2838

**ALLIS-CHALMERS, 932A SO. 70 ST.**
**MILWAUKEE, WIS.**

***Sold . . .***
***Applied . . .***
***Serviced . . .***

by Allis-Chalmers Authorized Dealers, Certified Service Shops and Sales Offices throughout the country.

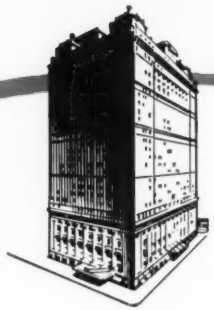
**CONTROL** — Manual, magnetic and combination starters; push button stations and components for complete control systems.

**TEXROPE** — Belts in all sizes and sections, standard and Vari-Pitch sheaves, speed changers.

**PUMPS** — Integral motor and coupled types. Sizes and ratings to 2500 GPM.

*Texrope* and *Vari-Pitch* are Allis-Chalmers trademarks.

# ALLIS-CHALMERS



Hotel Book-Cadillac
Detroit, Michigan

# "We Completely Eliminated Excessive Heating in a Master Control Switch in Our Hotel"

"The 800 ampere renewable fuses, formerly used in the switch controlling a generator, gave us a lot of trouble due to excessive heating. This heating caused them to open 4 or 5 times a year.

"The problem was a serious one.

"On January 22, 1948, we replaced the fuses with 600 ampere Fusetron fuses. That was 15 months ago and to date not one Fusetron fuse has opened. The Fusetron fuses are operating very cool and have completely eliminated the excessive heating in the switch.

"We're certainly pleased about the ability of Fusetron fuses to hold in this installation."

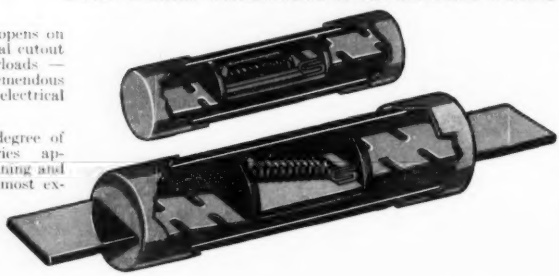
John E. Nesmith, *Chief Electrician*,
HOTEL BOOK-CADILLAC
Detroit, Mich.

**When we Switched to . . . . .**

## *Facts About FUSETRON Dual-Element FUSES*

The fuse link element opens on short-circuit — the thermal cutout element protects on overloads — the result, a fuse with tremendous time-lag and much less electrical resistance.

They have the same degree of Underwriters' Laboratories approval for both motor-running and circuit protection as the most expensive devices made.



Made to the same dimensions as ordinary fuses — fit all standard fuse holders.

Obtainable in all sizes from 1/10 to 600 ampere, both 250 and 600 volt types. Also in plug types for 125 volt circuits.

Their cost is surprisingly low.

# Fusetron DUAL-ELEMENT Fuses

with their

# 10 Point Protection

1. Protect against short-circuits.
2. Protect against needless blows caused by harmless overloads.
3. Protect against needless blows caused by excessive heating — lesser resistance results in much cooler operation.
4. Provide thermal protection — for panels and switches against damage from heating due to poor contact.
5. Protect motors against burnout from overloading.
6. Protect motors against burnout due to single phasing.
7. Give DOUBLE burnout protection to large motors — without extra cost.
8. Make protection of small motors simple and inexpensive.
9. Protect against waste of space and money — permit use of proper size switches and panels.
10. Protect coils, transformers and solenoids against burnout.

## Stop Wasting Time and Money

FUSETRON
TRUSTWORTHY NAMES IN ELECTRICAL PROTECTION
BUSS

**FUSETRON Dual-Element Fuses Give ALL-PURPOSE PROTECTION**

One needless shutdown — or one lost motor — or one destroyed switch or panel — may cost you far more than replacing every ordinary fuse with a FUSETRON dual-element fuse.

Don't risk such losses — protect yourself by installing a FUSETRON dual-element fuse in every set of fuse clips throughout the entire electrical system.

(FUSETRON is a trade mark of the Bussmann Mfg. Co., Division of McGraw Electric Co.)

Bussmann Mfg. Co., University at Jefferson
St. Louis 7, Mo. (Division McGraw Electric Co.)

Please send me complete facts about FUSETRON dual-element Fuses.

*Name*_____

*Title*_____

*Company*_____

*Address*_____

*City & Zone*_____ *State*_____ 1049

# ORANGEBURG
## FIBRE CONDUIT

**STANDARD**
Installed with Concrete

**NOCRETE**
Installed without Concrete

# Safeguarding America's "Nervous" System
# UNDERGROUND

Electric light, heat, power, communications . . . these UTILITY COMPANY services depend on the maintained effectiveness of a vast network of "nerves" – underground cables. These cables must have *permanent protection.* ORANGEBURG CONDUIT'S smoother bore and low coefficient of friction gives them this protection from . . . (1) *cable sheath abrasion* . . . (2) *strains* due to *pulling tension* . . . (3) *corrosion* . . . (4) *wear on sheath* from cable movement with changing loads.

For over 50 years, ORANGEBURG CONDUIT has given permanent protection to cables underground . . . helped the Electrical Industry to maintain a reliable and constant service for its customers.

On the evidence of its 50-year record underground, ORANGEBURG CONDUIT is made of materials so tough and strong that they seem to defy time . . . resist corrosive ground waters and chemical wastes *permanently.* The *pre-installation* story is favorable, too . . . easy to handle, transport, install . . . low initial as well as low maintenance costs.

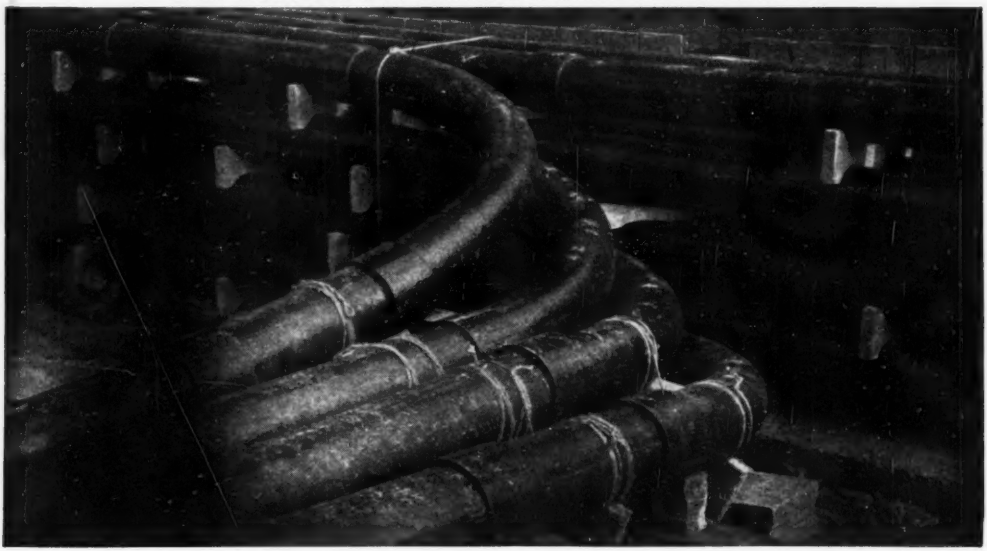
For more complete information write today for ORANGEBURG Catalog No. 50. Keep it for ready reference in your files.

ORANGEBURG STANDARD – For installation with concrete encasement. ORANGEBURG NOCRETE – For installation without concrete encasement.

Distributors · Graybar Electric Co., Inc.
General Electric Supply Corp.

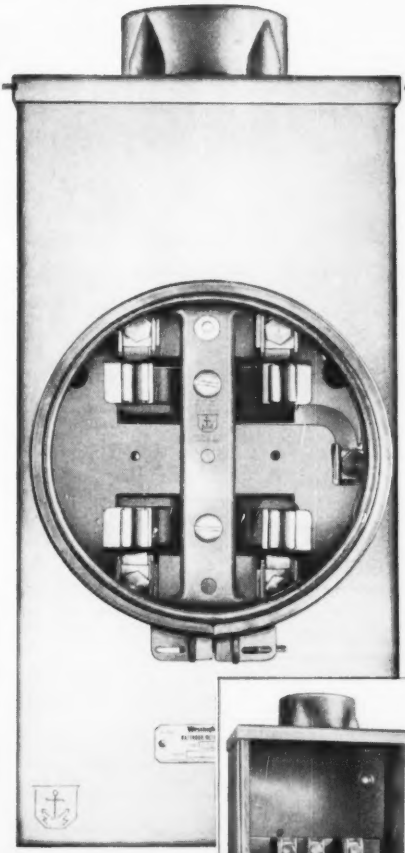
Orangeburg Manufacturing Co., Inc., Orangeburg, N. Y.

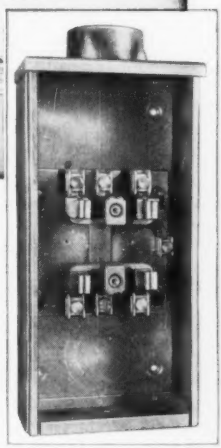
*Illustration below is* ORANGEBURG STANDARD *for installation with concrete encasement.*



YOU CAN BE **SURE**.. IF IT'S

# Westinghouse





Interior view of Type STU four-jaw socket with 2½" hub for use with single-phase, 50-ampere socket meter.

Also available: Type STU five-jaw socket with 2½" hub for use with 2-phase, 3-wire grounded neutral socket network meter. (Type-CS-5.)

# NEW

## 175 AMP. METER SOCKET

## *Cuts Costs!*

NOW you can eliminate the expense of special meter boxes by using the new Type STU meter socket for heavy current loads. Westinghouse has designed a self-contained socket that can take standard S-type meters. Installation costs are cut 'way down. Here are the reasons why:

A Socket takes up to No. 0000 cable . . . eliminating overheating. In fact, the large-size cable actually draws heat *away* from meter.

B Removable jaws and terminals in this new Westinghouse socket allow meter box to be mounted at convenience of contractor, prior to connecting up service wires.

C 175-amp socket uses standard parts and standard meters—allows the use of the right-sized conductor for the load requirements of the consumer.

Contractors will find this Westinghouse meter socket is just right for athletic fields, outdoor pumping installations, for electrically heated homes, for many other large load requirements. For more details on this moneysaving socket, ask for supplement to catalog 42-110, effective January 20, 1950. Call your nearest Westinghouse office or write Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pa. J-40375

Westinghouse
WATTHOUR METERS

# ALLIS-CHALMERS ANNOUNCES

# NEW High Voltage Air Contactor

★ *Cuts Space Requirements*

★ *Increases Contact Life... Reduces Maintenance*

★ *Now Available in High Voltage Starters*

FOR THE FIRST TIME a high voltage air contactor of approximately the same size as an oil immersed contactor is now available. Measuring only 15 x 25 x 38 inches, the Type 256 Contactor combines double break contacts, dual blowouts and special arc chambers to permit its space-saving design. The magnet and movable contacts operate with a straight line motion in the vertical plane eliminating the need for turning shafts, shaft bearings and flexible leads. Fewer parts mean longer life — less maintenance.

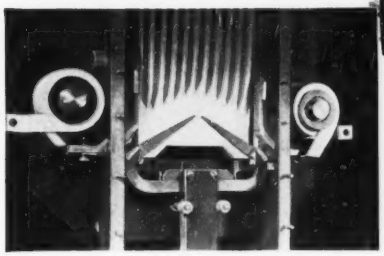
*You get increased contact life!* Double break contacts cut arc voltage in half. Integral arc runners remove the arc simultaneously with contact separation. Movable contacts are self-centering. Inserts of arc resistant alloy assure clean contact surfaces . . . These are points that add up to extra long contact life — more dependable start-stop service on your job.

The Allis-Chalmers line of High Voltage Starters has been expanded to include the use of Type 256 Contactors as well as oil contactors.

A-C ALLIS-CHALMERS **ALLIS-**

**SPACE SAVING** Features that result in space saving include: special arc chambers; double break contacts; dual blowout structure; and vertical action.

**SPECIAL ARC CHAMBER** The arc chute is designed to take fullest advantage of the dual blowouts. Interleaving fins and dividers lengthen the arc in both horizontal and vertical planes.



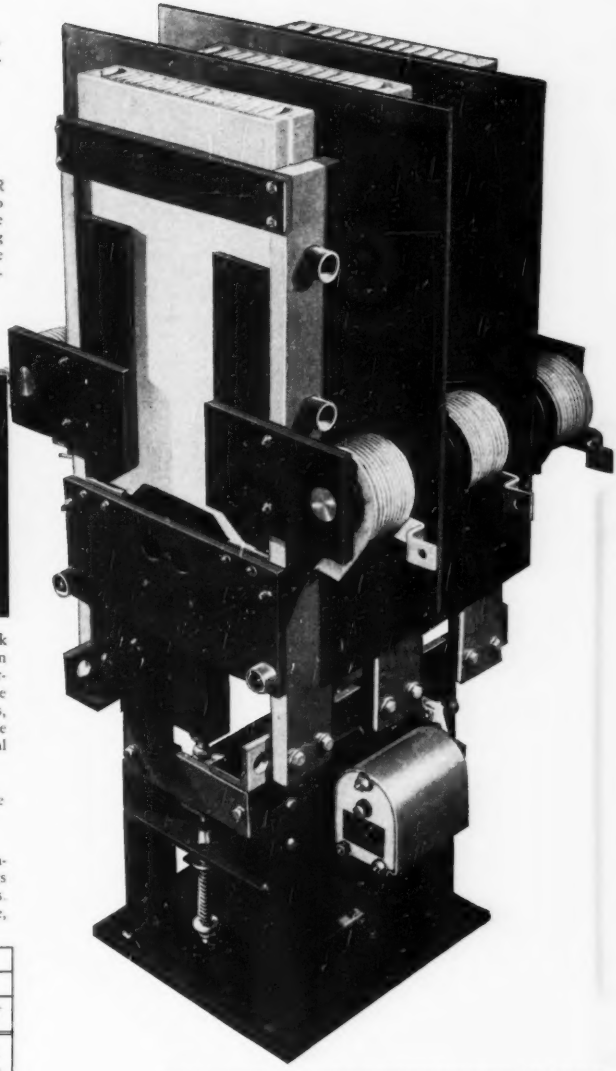
**DUAL BLOWOUT STRUCTURE** Each contact break is provided with a continuous duty blowout coil, an arc horn and an arc runner. At low currents this arrangement acts to snuff out quickly the two separate arcs before entering the arc chutes. At higher currents, the two arcs are propelled rapidly until they join. The single arc thus formed is extinguished in the special arc chute.

**DOUBLE BREAK CONTACTS** eliminate flexible leads, turning shafts and shaft bearings.

**PLUS THESE EXTRA FEATURES** Movable contacts are self-aligning and have pressure adjustments to assure positive anti-bounce closing of both gaps. These are features that add up to dependable service, long contact life and low maintenance.

| Poles | Ampere Rating Continuous Duty (8 Hr. Basis)* | Max. Volts | Maximum Horsepower | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | 2200-2300 Volts | | | 4000-4600 Volts | | |
| | | | Synchronous | | Induction | Synchronous | | Induction |
| | | | 1.0 P.F. | 0.8 P.F. | | 1.0 P.F. | 0.8 P.F. | |
| 3 | 200 | 2300 | 900 | 700 | 700 | — | — | — |
| 3 | 400 | 2300 | 1250 | 1000 | 1500 | — | — | — |
| 3 | 200 | 5000 | — | — | — | 1500 | 1250 | 1250 |

Yes, Allis-Chalmers Type 256 Contactor is available arranged for reversing and dynamic braking. Utilize the advantages of this new completely tested air contactor in new controls or as a replacement device. Send the coupon now or call your A-C Sales Office.



# CHALMERS

ALLIS-CHALMERS, 932A SO. 70 ST.
MILWAUKEE, WIS.

Gentlemen:

Please send advance information on the New Type 256 High Voltage Air Contactor.

Name

Title

Company

Address

City State

A-2841

# A good *twist* to the story of a twister!

**After a recent cyclone** snarled up power lines near St. Louis, one bright spot was the speed with which wires were re-strung and normal service restored.

The KBS-8 above is one of a group of International Trucks that played a big part in the emergency operation. Crews were able to pitch in fast on their job because rugged, dependable Internationals were ready to pitch in fast on *their* job.

Truck dependability, power and stamina are important not only in emergencies but also throughout the year. An unreliable truck on a utility job can tie up expensive equipment and manpower, wreck maintenance schedules.

That's why it *always* pays to have rugged, dependable International Trucks working for you. In International's complete line there's a truck for every utility hauling job. 22 basic models, 1,000 truck variations range in GVW from 4,400 to 90,000 lbs.

In addition to a complete line, International offers complete service facilities wherever you drive a truck. America's largest exclusive truck service organization—4,700 Dealers and 172 Company-owned Branches—stands behind every International Truck model. You're always close to precision-engineered International Truck parts, factory-rebuilt exchange units, factory-trained mechanics.

For the right truck to solve your motor truck transportation problems efficiently . . . economically, get in touch with your nearest International Truck Dealer or Branch.

International Harvester Builds
McCormick Farm Equipment and Farmall Tractors
Motor Trucks . . . Industrial Power
Refrigerators and Freezers

*Tune in James Melton and "Harvest of Stars"*
*NBC, Sunday afternoons*

**INTERNATIONAL TRUCKS**

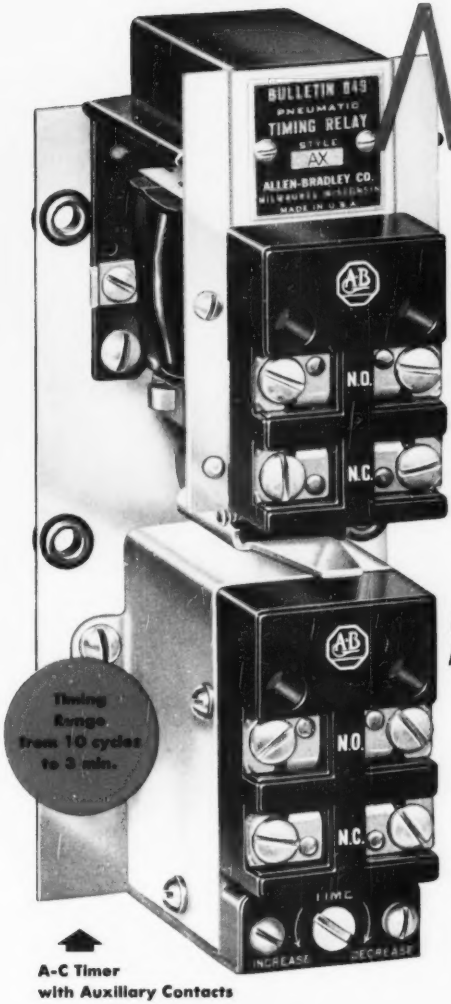
INTERNATIONAL HARVESTER COMPANY · CHICAGO

# NEW...

## Bulletin 849

# PNEUMATIC TIMING RELAY

### Good for Millions of Operations




A-C Timer with Auxiliary Contacts

D-C Timer

- FOR "DASH UP" OR "DASH DOWN" OPERATION
- AVAILABLE FOR NEMA TYPE 1, 4, 7, and 9 APPLICATIONS

This new, compact, solenoid type, pneumatic timing relay utilizes a synthetic rubber bellows for controlling the tripping time. Has a range of from 10 cycles to 3 minutes, and an accuracy of approximately ±10%. Its setting is easily adjustable over a wide range, and the relay resets instantaneously. This timer will provide satisfactory operation irrespective of temperature, humidity, or vibration conditions. Available with quick make and quick break, double pole, silver alloy main contacts—one set normally open and one set normally closed. Terminals are readily accessible from the front. A duplicate set of contacts for pilot control can also be provided, actuated directly from the solenoid. The unit can be readily changed from "dash up" to "dash down" operation by simply inverting the solenoid. Write for information on this new Bulletin 849 Pneumatic Timing Relay.

ALLEN-BRADLEY CO.
1316 S. Second St., Milwaukee 4, Wis.

ALLEN-BRADLEY
QUALITY
MOTOR CONTROL

A-B Quality

# OTHER RELIABLE TIMING RELAYS

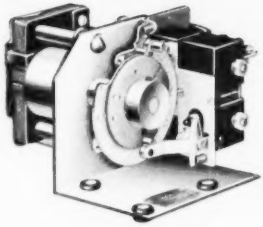
TO FIT YOUR REQUIREMENTS

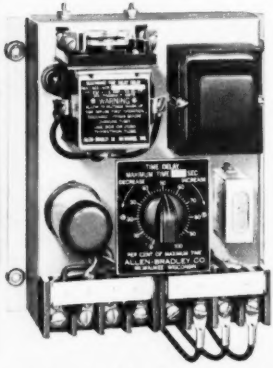
## BULLETIN 850
## MOTOR DRIVEN TIMING RELAY

Designed for timing comparatively long intervals with a high degree of accuracy where high speed recycling is not required. Furnished in several ranges with a maximum time delay of from 1 to 15 minutes. Variations in time between successive operations are less than 1% of the full scale range. Its synchronous motor is suitable for a-c pilot control service only. Has a single pole switch for normally open or normally closed operations.

## BULLETIN 850
## TYPE L LAUNDRY TIMER

Similar in design to the Bulletin 850 Motor Driven Timing Relay, this timer is specially designed for controlling washing machines and other equipment where the motor is run for a given period in one direction, reversed, and then run in the opposite direction.






## BULLETIN 852
## ELECTRONIC TIMING RELAY

Designed primarily for exact timing in frequent operation. It has a range of 20 to 1 and is provided in eight timing ranges with from ½ second up to 2 minutes maximum time delay. The reset time is approximately one-tenth of the maximum time delay. This is a flexible timer that can be recycled rapidly over long periods. Furnished with two normally open, two normally closed, or one normally open and one normally closed contacts.

## BULLETIN 848
## FLUID DASHPOT TIMING RELAY

Here is a magnetic type timing relay that combines simplicity, dependability, and low cost. It can be used in many applications where reliability is more important than exactness of timing. Operates at ambient temperatures from +120 F to −30 F without undue variations in timing. Has an adjustable range from 2 to 20 seconds and is available for a.c. or d.c. . . . in single pole construction . . . with either normally open or normally closed contacts.

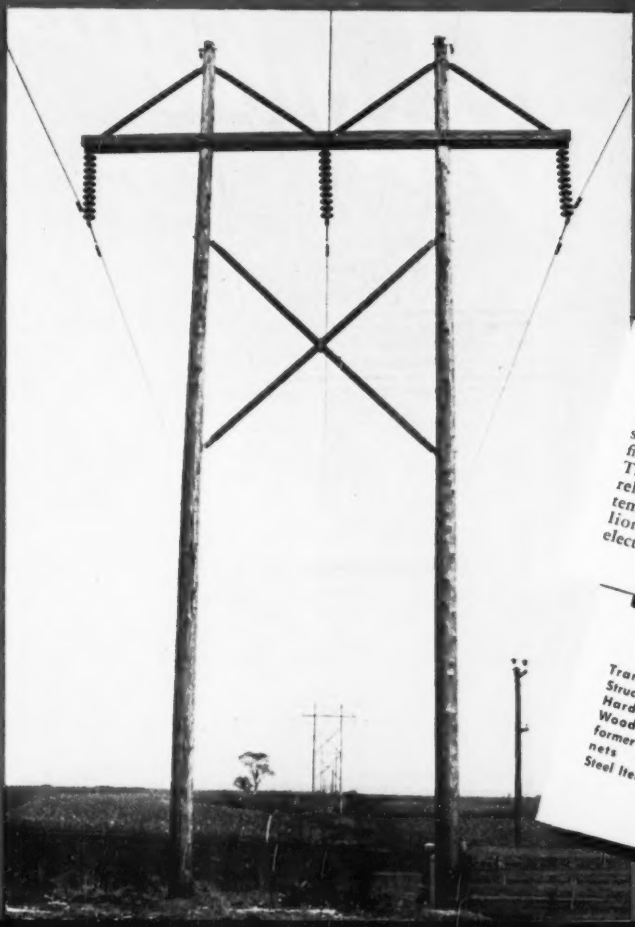
# ALLEN-BRADLEY

MOTOR CONTROL

**Write for New Timer Bulletin**

Allen-Bradley Co.,
1316 S. Second St.,
Milwaukee 4, Wis.

# *Hughes* DEPENDABLE
## X-BRACED
# TRANSMISSION STRUCTURES



Tangent Structure used for 161 KV operation on 500 mile line in the heavy loading district.
Normal Span — 750'.
Conductor — 397500 ACSR.
"Hughes" Factory Assembled Double Arm with 3½" x 8¼" x 32'-0" side arms and "Hughes" No. 2880 metal spacer fittings.
"X" Braces are "Hughes" standard #1042.
"Knee" Braces are "Hughes" standard #2025.

HUGHES BROTHERS *developed and pioneered "X-Braced" construction,* worked out the structural theory, and confirmed it by full-sized tests. The results: Thoroughly reliable transmission systems, and savings of millions of dollars for the electric utility industry.

*Manufacturers of*
Transmission and Distribution Structures • Transmission Line Hardware • Prefabricated Wood Substations • Transformer Platforms • Wood Bayonets • Special Wood and Steel Items.

☆

WHEN IT'S HUGHES . . .
*It's Tailored*
TO YOUR NEEDS

HUGHES SEWARD
FOUNDED - 1921

"HUGHES" TRANSMISSION & DISTRIBUTION MATERIAL MEN WOOD METAL

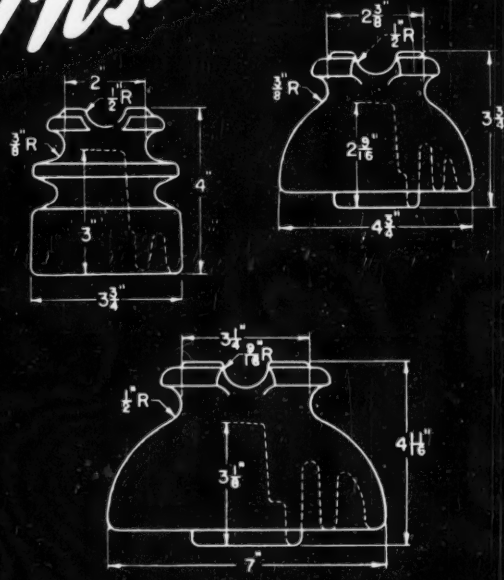
BROTHERS NEBRASKA
INCORPORATED

# J-D

*Write for Bulletin No. 500*

★ ★ ★ ★ ★

# LOW VOLTAGE PIN TYPE *Insulators*




## JEFFERY-DEWITT INSULATOR CORP.

Kenova, West Virginia, U.S.A.

★ ★ ★ ★ ★ ★ ★ ★

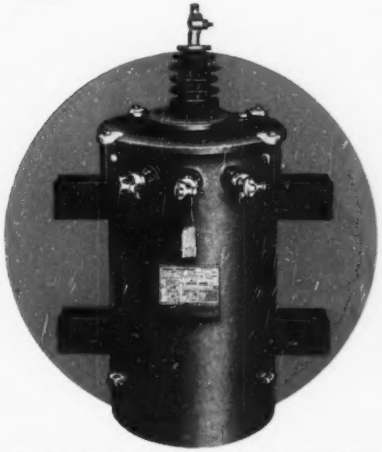
# Wagner Rural Line Transformer Service

## Expert RECONDITIONING GENUINE PARTS

All transformer repair parts are Genuine Wagner Parts and exact duplicates of those in new Wagner Transformers. A few are illustrated and described below.

Wagner Electric Corporation, pioneer builder of transformers, offers a complete line of repair parts and reconditioning service for Wagner Rural Line Transformers — Genuine Repair Parts for "on-the-spot repairs"... or "Factory Reconditioning Service" for transformers that need a complete overhauling... just send them to the nearest Wagner Service Branch.

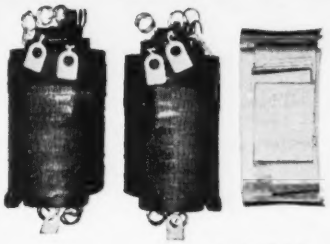
Take advantage of this service — check your Rural Line Transformers and keep them at top efficiency with Wagner Repair Parts and Expert Reconditioning Service.



### COMPLETE REBUILDING SERVICE

This service consists of cleaning and painting of transformer, installing all new gaskets, installing new factory-wound coils and insulation and a thorough factory test. A one year warranty against defective material and workmanship applies on all transformer rebuilding jobs. Ship transformer to us prepaid and we will pay return freight charges. Oil, broken or missing bushings, or other major parts are extra. If the transformer does not require complete rebuilding, repairs will be made on a time and material basis.

**Wagner Electric Corporation**
**6456 Plymouth Ave., St. Louis 14, Mo.**

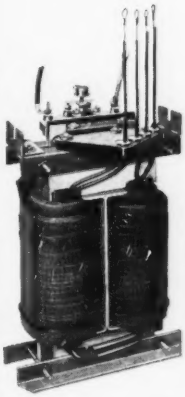


COILS AND INSULATION

A complete set of coils and all necessary insulation for mounting on your own core. A gasket kit is included.

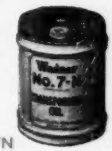
GASKET KIT

A complete set of all composition gaskets used throughout the transformer.



NEW INTERIOR

Consists of complete, new core-and-coils assembly with a terminal board or tap changer, with leads ready to install in your tank. A gasket kit is also included.

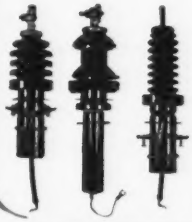



TRANSFORMER OIL 7N

Genuine Wagner 7N Transformer Oil. Available in 1, 3, 5, 20, 30 and 50 gallon containers.

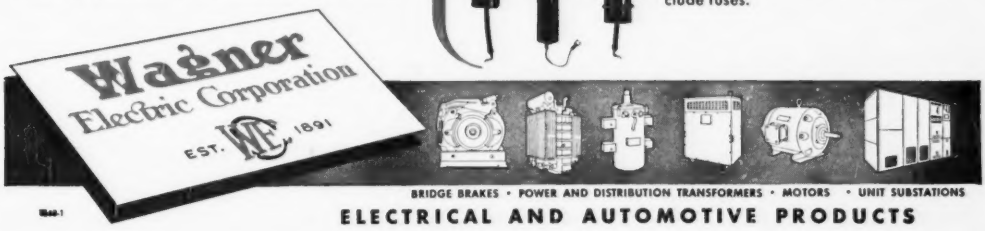
LOW VOLTAGE BUSHING ASSEMBLY

Includes porcelain bushing, composition gasket, solderless connector-type terminal and clamping device.



HIGH VOLTAGE BUSHING ASSEMBLIES

Available in various types to meet a wide range of requirements. They do not include fuses.




BRIDGE BRAKES • POWER AND DISTRIBUTION TRANSFORMERS • MOTORS • UNIT SUBSTATIONS

**ELECTRICAL AND AUTOMOTIVE PRODUCTS**

# *Let's Look at the* CONTACTS

The "MK-40" air switch has many new features, all essential to give better, smoother and easier operation. Most vital of these are the HIGH PRESSURE CONTACTS at both ends of the switch blade. Their design is of primary importance on an outdoor air switch exposed to year-round weather and corrosive atmospheric conditions.

### *WHEN PURCHASING OUTDOOR SWITCHES BE SURE THAT . . .*

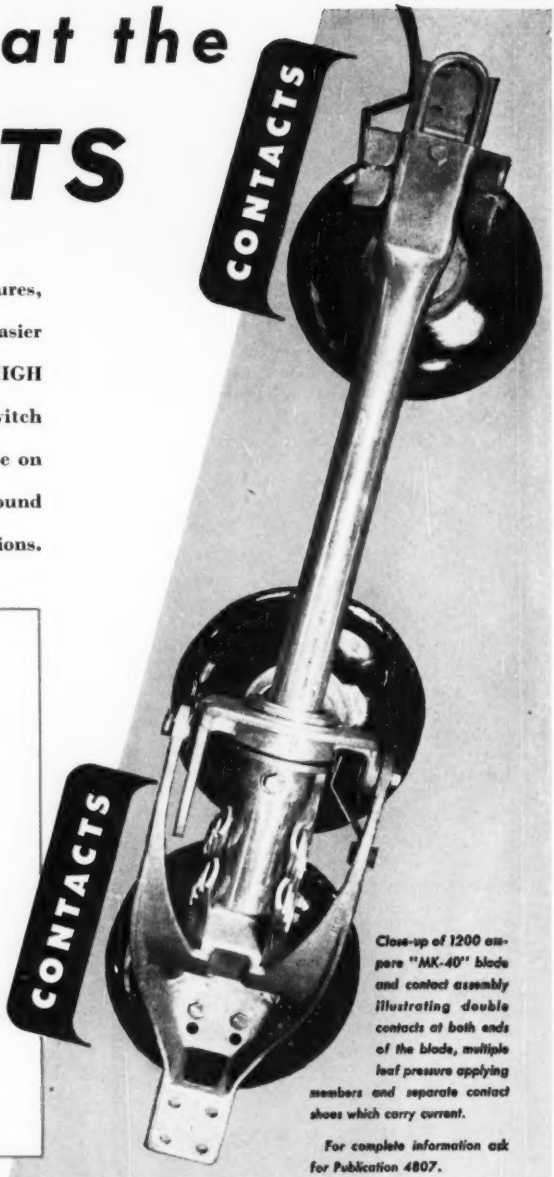
1. The current carrying function of the contact is independent of the pressure applying members to take full advantage of the electrical and mechanical characteristics of the materials used.

2. Large contact pressure spring deflection is employed to maintain constant contact pressure for a long period of years.

3. Rolled or drawn sections are used instead of cast sections for uniform values of density, homogeneity, physical conformity and electrical conductivity.

4. The contact material is a good heat conductor with ample volume to carry away contact heat generated under short circuit.

5. Metals at the point of contact are silver to copper which resist corrosion and abrasion better than any other combinations which can be made of copper and its alloys.




*Close-up of 1200 ampere "MK-40" blade and contact assembly illustrating double contacts at both ends of the blade, multiple leaf pressure applying members and separate contact shoes which carry current.*

*For complete information ask for Publication 4807.*

**CONTACTS ON THE "MK-40" ARE DESIGNED TO THESE STANDARDS**

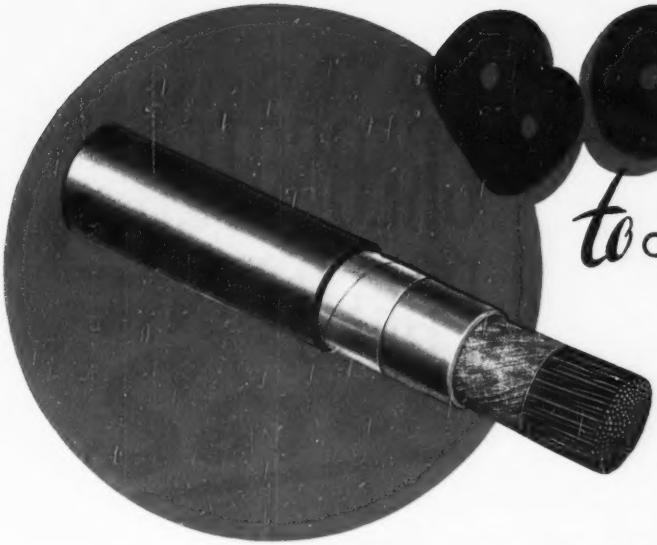

**DELTA-STAR ELECTRIC COMPANY**

MAIN OFFICE AND FACTORY — 2400 Block, Fulton St., Chicago 12, Ill.
NEW YORK OFFICE — 140 Cedar St., New York 6, N. Y.

DISTRICT REPRESENTATIVES IN THE FOLLOWING CITIES

Birmingham, Ala.
Boston, Mass.
Buffalo, N. Y.
Charlotte, N. C.
Cleveland, Ohio
Dallas, Texas
Denver, Colo.
Detroit, Mich.
Indianapolis, Ind.
Jacksonville, Fla.
Kansas City, Mo.
Knoxville, Tenn.
Los Angeles, Cal.
Minneapolis, Minn.
Norfolk, Neb.
Norfolk, Va.
Philadelphia, Pa.
Pittsburgh, Pa.
Richmond, Va.
Roanoke, Va.
St. Louis, Mo.
San Francisco, Cal.
Seattle, Wash.
Tampa, Fla.
Washington, D. C.
Honolulu, Hawaii

CANADIAN ASSOCIATE
Canadian Line Materials Limited — Toronto 13, Canada



# Boon to COMMUNICATION CIRCUITS

Here's good news for long-range communication circuits ... a new Simplex Polyethylene - PLASTEX Communication Cable that insures increased signal strength under all conditions of aerial, duct, and underground service.

Insulated with a thin wall of Polyethylene over each conductor and protected by an outer jacket of PLASTEX, this new Simplex cable is small in diameter and exceptionally light in weight.

But here are the features that make it "tops" for performance and dependability ...

The polyethylene insulation has low power factor and low dielectric constant — your assurance of maximum transmission distance. It is especially suitable for circuits having carrier frequencies exceeding 50 kilocycles. It provides high insulation resistance and unusually low water absorption.

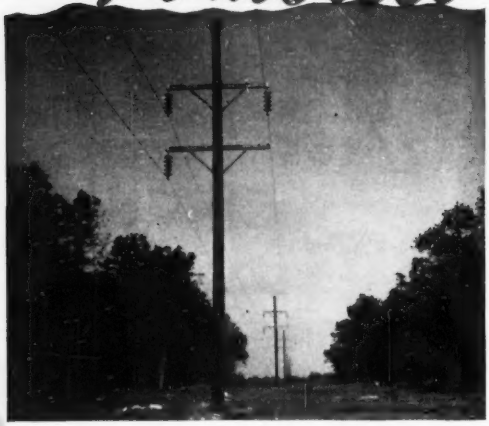
The specially - compounded PLASTEX jacket is tough, flexible, and protects the cable against oxidation, flame, water, oil, chemicals, sunlight and weather hazards. Its stability over a wide temperature range permits operation at temperatures as high as 176°F. in dry locations, 140°F. in wet or oily locations. It assures resistance to cracking at temperatures as low as −58°F.

For more complete information and, if you wish, help in working out the details of your circuits, contact the Simplex representative in your area or write direct.

## SIMPLEX WIRES AND CABLES

SIMPLEX WIRE & CABLE CO., 79 SIDNEY ST., CAMBRIDGE 39, MASS.

# Amcreco CREOSOTED POLES



do 3 big jobs

1 **INCREASES LIFE EXPECTANCY OF YOUR LINES** Carefully selected, naturally strong timber is scientifically pressure treated the entire length to produce poles of highest strength and durability. Service records showing from 25 to 40 years of useful pole life prove the long life expectancy of Amcreco creosoted poles.

2 **LOWERS INITIAL COST . . . REDUCES MAINTENANCE EXPENSE** — Poles of practically constant strength promote pole line economy. Smaller sizes and longer spans are possible . . . a lower factor of safety can be allowed . . . lines stay up longer . . . fewer replacements of poles and cross arms are required.

3 **GIVES DEPENDABLE SERVICE UNDER SEVEREST CONDITIONS** — Lines constructed with Amcreco poles are planned for the future. Built for permanence and dependable service under all conditions, Amcreco creosoted poles provide greater long-term economy.

Get the whole story about long lasting, money saving Amcreco poles. Ask for detailed information on actual service records. Write today.

**Amcreco**
*Lowry Process*
**Creosoted Products**

**POLES**
**CONDUIT**
**CROSS ARMS**

AMERICAN CREOSOTING COMPANY
INCORPORATED
COLONIAL CREOSOTING COMPANY INCORPORATED
AMCREC LOWRY PROCESS CREOSOTED
GEORGIA CREOSOTING COMPANY INCORPORATED
LOUISVILLE KENTUCKY

*Pressure treated for strength that lasts*

# FOR DEHYDRATING INSULATING OIL— My Work is Safer

"I am De Laval Centrifugal Force. My method of purifying insulating oil in the bowl of a De Laval Oil Purifier is more than 25 years old but is still the ***safest*** method. There are two reasons why my centrifugal method still tops all others:

"1. Centrifugal force removes all water from the oil, and continuously discharges it to waste. Water once removed cannot contaminate the oil all over again and render it suddenly ineffective. No danger that a batch of oil will go from a high to a low dielectric in an instant!

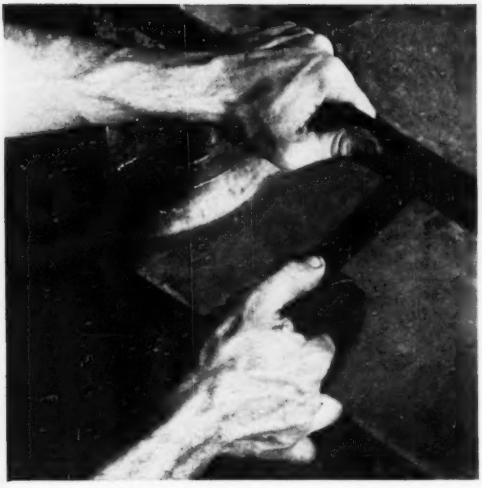
"2. Centrifugal force is ***quicker*** — action is practically instantaneous and purification can be effected in a matter of seconds rather than minutes or even hours."

## ADVANTAGES OF DE LAVAL INSULATING OIL PURIFIERS

- Dehydrates at a single pass — no re-running
- Constant high purifying efficiency — no shutdowns for cleaning or for renewal of parts during run
- Safest — continuous discharge of water prevents re-contamination of the insulating oil
- Removes water without aid of filter press; press used only to remove colloidal carbon
- Low temperature purification; high dielectric value of oil maintained longer
- Heater cannot carbonize the oil
- Higher daily capacity of purifier saves maintenance costs
- More economical to operate

THE DE LAVAL SEPARATOR COMPANY
165 Broadway, New York 6 427 Randolph St., Chicago 6
DE LAVAL PACIFIC CO., 61 Beale St., San Francisco 5
THE DE LAVAL COMPANY, Limited, Peterborough, Ont.

De Laval
INSULATING OIL PURIFIERS



## pull it tight!

**High dielectric strength under elongation and high breaking strength make EMPIRE Utility Bias Tape ideal for applications requiring tight wrappings.**

## wrap it smooth!

**Because of its flexibility, Utility Bias Tape can be wrapped smooth, without coning, on irregular surfaces like the high tension leads shown above.**

# Empire® UTILITY BIAS TAPE**

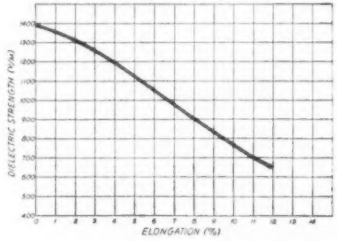
## tried...and found right!

A leading West Coast utility company tried EMPIRE Utility Bias Tape, and found it just right for the tough insulation jobs—busbar insulation, spiral coil wrappings, high tension leads, high tension cable splices, and other irregular conductors.

EMPIRE Utility Bias Tape stands alone in providing exceptionally high dielectric strength under elongation (see graph). Use of the finest base cloth and a specially-formulated varnish also give it good stretch and flexibility. It can be wrapped tight and smooth with complete confidence in retained high dielectric strength values.

Utility Bias Tape is dependably uniform, and has good aging characteristics. It is one of many fine products in a complete line of high quality electrical insulation materials developed by Mica Insulator Company, leader in this field for over 56 years. For further information, contact our nearest sales office.

**U.S. Pat. No. 2,355,632




**It retains high dielectric strength values!**

**Graph shows dielectric strength of .012th. Empire Utility Bias Tape at various percentages of elongation. Meets all requirements of ASTM Specification D-373-44T.**

MICA Insulator COMPANY

**Schenectady 1, New York**

*Offices in Principal Cities*

# Skymount

## THAT REACHES EVERYWHERE

### UP—OVER—AND—AROUND

***Provides safer . . . easier maintenance***

**High light standards . . . around and over parked cars . . . maintenance of hard-to-reach signs—the Keystone Ladder Mount reaches them all with ease and safety. There's greater strength and rigidity than ever before. Perfect balance of ladders and handwheel control of "fly" ladder lessens physical strain and speeds up work. Handwheel device also eliminates hazard of rope on the truck floor.**

**The ease with which it is used certainly earns its nickname of "SKY-MOUNT". It is compact and requires only 21-inch radius of body space . . . ladder can be rotated through 360°. Its vertical approach ladder saves space and permits rapid ascension.**

**If you want to speed up maintenance and increase safety, equip your trucks with Keystone Ladder Mounts. Sizes include 24 feet, 28 feet and 32 feet. For full details write for complete catalog.**



**GETS AROUND PARKED CARS**

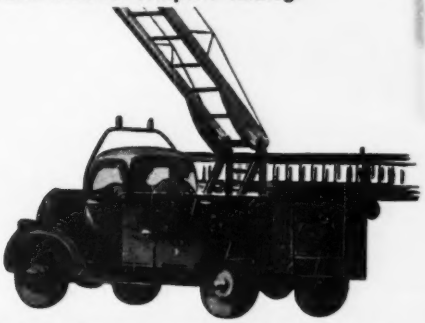
With the Keystone Ladder Mount, service can be carried on right over or around parked cars.

**REACHES HIGH PLACES**

With the new 32-foot length ladder mount, it is possible to service the highest signs or light standards.

**PERFORMANCE-PROVED**

Utilities, municipalities, petroleum companies, sign companies, etc., throughout the nation have proved its value on thousands of trucks.



## ELECTRIC SERVICE MANUFACTURING CO.

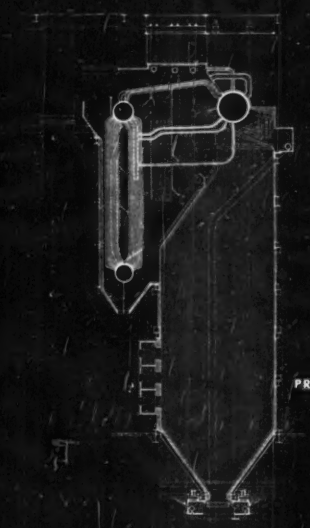
1709 CAMBRIA STREET PHILADELPHIA 32, PA.

# More power per lb of process steam

**Foster Wheeler Dual Circulation Steam Generators at Whiting Refinery of the Standard Oil Company (Indiana) help achieve this goal**

During the ninety years since the world's first oil well was drilled on the banks of Oil Creek, near Titusville, Pa., petroleum processing has evolved into an advanced science. Many new processes, resulting from continued achievements in refining practices, are being made commercially possible because petroleum engineers are alert to techniques for in-

## 1350 psi, 900 F operation with 100% make-up




Cross section of one of five FW Dual Circulation Steam Generators at the Whiting Refinery. Each of the two separate heat absorbing sections has its own independent circulating system.

Five FW Dual Circulation Steam Generators at Whiting deliver 300,000 lb of steam per hr each at 1350 psi, 900 F operation with 100% make-up. Because of the unique design, steam can be generated with minimum blowdown. The carryover of both solids and vaporized silica is substantially below that of standard circulation units. This assures trouble-free operation at high pressures and temperatures.

## low maintenance—high turbine availability

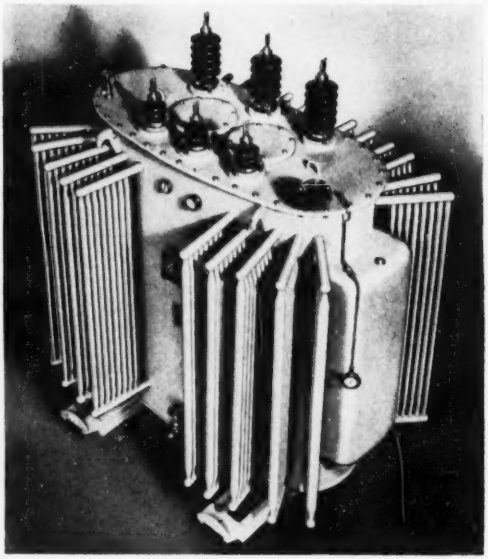
Expensive outages for removal of silica and other deposits from turbine blades are prevented.

creased economy in refinery operations. The FW Dual Circulation Steam Generator is an important development in the interest of economy and helps reduce the cost of power and process steam production.

**FOSTER WHEELER CORPORATION**
165 Broadway • New York 6, N.Y.

FOSTER WHEELER

# The WHO WHAT WHY WHEN and WHERE



## on how you can SAVE UP TO 8% by specifying

# PENNSYLVANIA STANDARD PARTS POWER TRANSFORMERS

### WHO Can Use Pennsylvania Standard Parts Power Transformers?

Practically all utilities and industrials can use Pennsylvania Standard Parts Power Transformers because the electrical ratings and accessories are in accordance with A.S.A. and NEMA Standards. To meet a wider range of system requirements, variations are permitted both in accessories and in electrical characteristics. For example: Any accepted method of oil preservation can be had with Standard Parts transformers.

### WHAT Are Pennsylvania Standard Parts Power Transformers?

They are single or three phase Power Transformers, now manufactured in sizes up to 10,000 Kva and up to 69 Kv. Transformers are "Standard" when they conform to standard voltage ratings and are equipped with standard accessories in standard locations. For such transformers a full discount of up to 8% is applied. When voltages are other than standard, but within a certain voltage rating, slightly lower discounts are applied.

### WHY Do Standard Parts Power Transformers Sell for Less?

Because quantity production methods of manufacturing, coupled with the use of standard designs and standard parts, shorten engineering and production time which, in turn, reduces the price of the transformer by as much as 8%.

### WHEN Can Deliveries Be Made on Standard Parts Power Transformers?

On some ratings, deliveries can be made 3 or 4 weeks from the time an order is entered. On other larger ratings, deliveries can be made in a comparatively short time.

### WHERE Can More Information on Standard Parts Power Transformers Be Obtained?

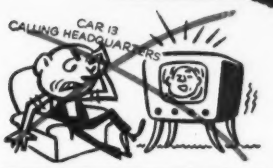
By writing to Pennsylvania Transformer Company, Box 330, Canonsburg, Pennsylvania and asking for a copy of Catalog No. 1492.

Pennsylvania TRANSFORMERS

**TRANSFORMER COMPANY**

**Canonsburg, Pa.**

*Greater Pittsburgh District*




**Low Spurious Emission.** The FLEETFONE more than meets FCC rules. Spurious emissions are well down at all frequencies—not just in the 30-50 Mc band alone.

**Low Spurious Response.** This feature cuts out annoying interference from transmitters operating on other frequencies.

**Transducer Modulation Control.** It holds your voice level constant whether you shout or whisper into the "mike." Introduces no distortion at high levels. This feature more than meets FCC rules.

# HERE'S YOUR ANSWER

## to better 2-way radio communication

It's here—everything you want in a *single* compact unit—the RCA FLEETFONE.

**Higher Power Output.** Your choice of 30 or 60 watts in the same size package.

**Easy to Install.** "Sandwich" construction offers the widest choice of installation possibilities.

**Higher Sensitivity.** Better than 0.3 microvolt, that brings in the signals after other receivers have lost them.

**Low Spurious Emission.** 60 db down at *all* frequencies; 80 db down between 30-50 Mc.

**Low Spurious Response.** 90 db over *all* frequencies; images down 100 db.

**"Canyon-Curve" Selectivity.** Prevents annoying interference from neighboring channels.

**Transducer Modulator Control.** Keeps you from "crowding" into the other fellow's channel.

**Choice of 6- or 12-volt Operation.** Ideal for lightweight vehicles or heavy trucks.

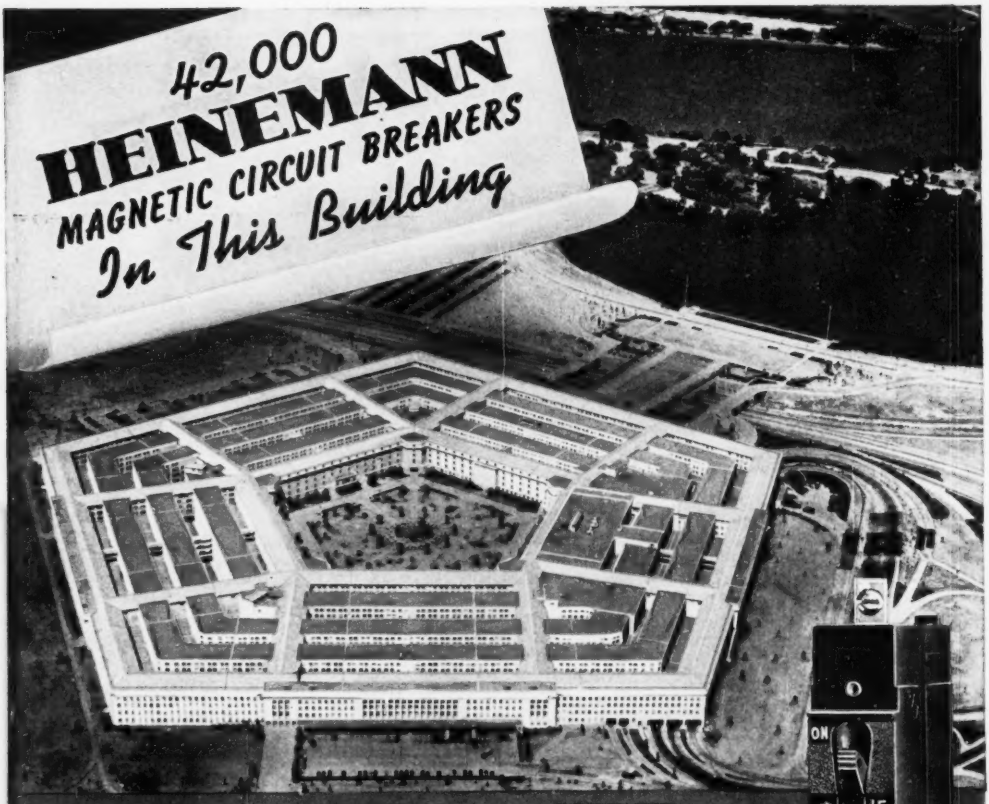
**More than Meets All FCC Rules.** Your assurance of best possible mobile communication. Your protection against early equipment obsolescence.

For complete information, write Department 31J, RCA Engineering Products, Camden, New Jersey.

*MOBILE COMMUNICATIONS SECTION*
**RADIO CORPORATION of AMERICA**
*ENGINEERING PRODUCTS DEPARTMENT, CAMDEN, N.J.*

In Canada: RCA VICTOR Company Limited, Montreal

# 42,000 HEINEMANN MAGNETIC CIRCUIT BREAKERS In This Building



**The heading of this advertisement speaks volumes. We do not think it necessary to say more. But we would like to have you know why the Heinemann Magnetic Circuit Breaker is so highly regarded in the electrical industry.**

**In the first place, it is *entirely magnetic*. In case of short circuit, the breaker trips INSTANTLY, before the wire has a chance to heat. It can be re-closed at once, provided the "short" no longer exists. Also, since NO HEAT is generated, it always carries 100% of rated capacity. No "de-rating" factor is needed.**

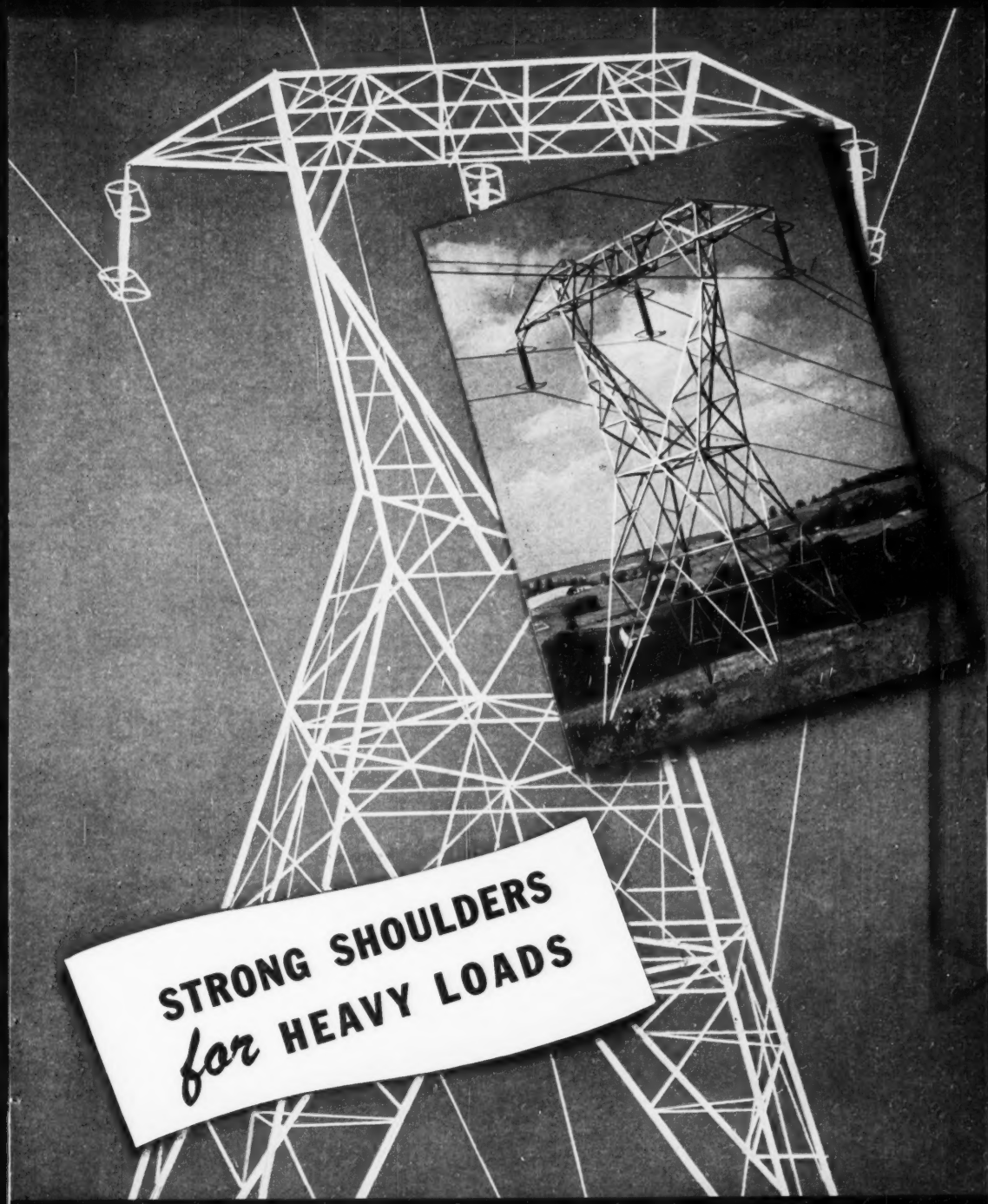
**In the second place, it is extremely flexible. A magnetic-hydraulic time-delay unit adapts the breaker to current conditions so that it will not trip on minor overload or starting surge. A pre-determined safe amount of time will elapse before tripping.**

*It would be well worth your while to write us for further information*

EST. HECC 1888

## HEINEMANN ELECTRIC COMPANY

**103 PLUM STREET** **TRENTON, NEW JERSEY**




# BLAW-KNOX TRANSMISSION TOWERS

BLAW-KNOX DIVISION OF BLAW-KNOX COMPANY • 2013 FARMERS BANK BLDG., PITTSBURGH, PA.

NEW YORK CHICAGO PHILADELPHIA BIRMINGHAM WASHINGTON

# NEVER BEFORE!

## A G-E General-Purpose* Insulating Varnish

WITH THESE OUTSTANDING CHARACTERISTICS

*G.E.'s new 9574*

### ☑ EXCELLENT BONDING STRENGTH

**General-purpose 9574** has excellent bonding properties. It is ideal for all types of motor windings (except extra high-speed armatures), and has outstanding electrical characteristics.

### ☑ EASIER TO WORK

**G-E 9574** is a phenolic drying-oil varnish. It's particularly easy to use and handle. It has an unusually high flash point (100 F), and its viscosity (250 C. P. average at 45 F) makes it usable at barrel gravity.

### ☑ NO SPECIAL THINNERS REQUIRED

**G-E 9574** can be thinned with ordinary petroleum spirits up to 20%.

### ☑ CURES AT LOW TEMPERATURES

**This clear-baking varnish** cures at low temperatures. A baking cycle as low as 212 F is successful in conventional baking equipment.

### ☑ PENETRATES DEEPEST COILS

**G-E 9574** easily penetrates the deepest coils, forms an even film. Aging properties are excellent.

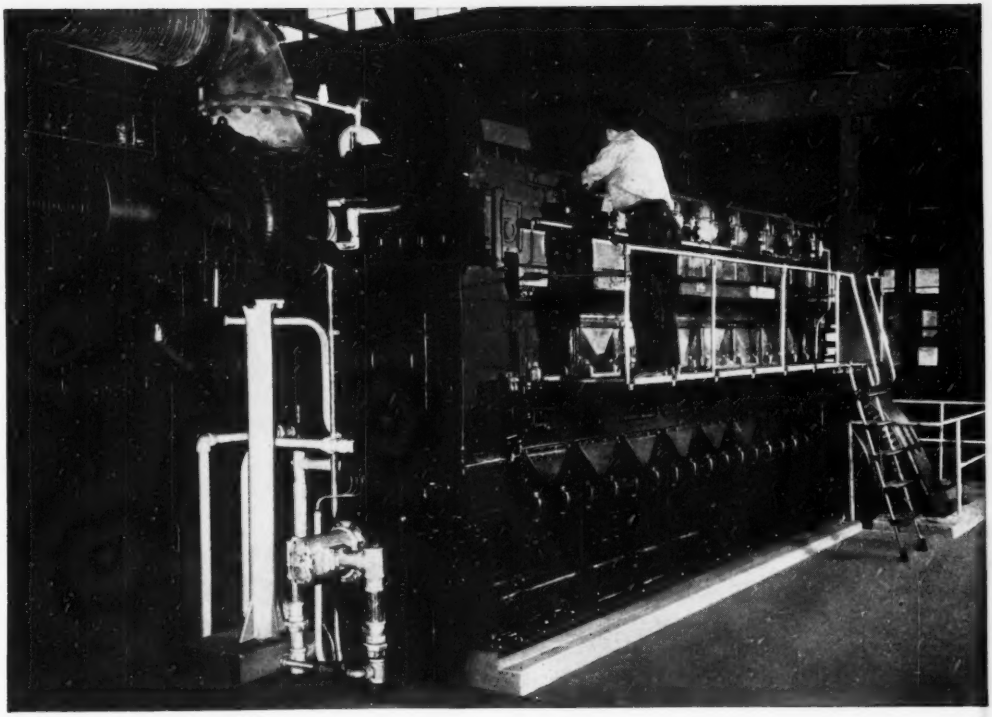
**G-E 9574 gives excellent results on all types of coils except extra high-speed armatures.*

**MAKE YOUR MOTOR REPAIRS EASIER, MORE EFFICIENT BY USING G-E 9574!**

Get more information on this remarkable general-purpose insulating varnish. New bulletin gives you full details. Just write to your local G-E Distributor or Chemical Department, General Electric Company, Pittsfield, Mass.

***You Can Put Your Confidence in***

**GENERAL ELECTRIC**



## THERE WAS WATER FOR EVERYTHING

## *. . . but only a trickle for power*

In 1948 one of the largest power plants in the East was faced with a serious lack of water for hydro-electric power purposes.

They knew they had to prevent a power shortage . . . so they decided to install a Diesel generating unit just as quickly as possible. Officials of this utility company contacted our Superior Engine Division and told them about their problem.

In just 72 days from the time the order was placed, Superior had delivered and helped complete the installation of a 1000 KW generator unit, powered by an 8 cylinder, 1440 hp. turbo-charged Superior Diesel. This installation proved so successful that recently they ordered another Superior.

Yes, you can depend on our Superior Engine Division for outstanding service whenever it is needed. And you can be sure that Superior Diesels will provide an equally dependable source of power. We would appreciate an opportunity of showing you the advantages they offer.

**THE NATIONAL SUPPLY COMPANY**
**SUPERIOR ENGINE DIVISION**
**Plant and General Sales Office: Springfield, Ohio**

THE NATIONAL SUPPLY COMPANY NSCO

*Superior* DIESEL

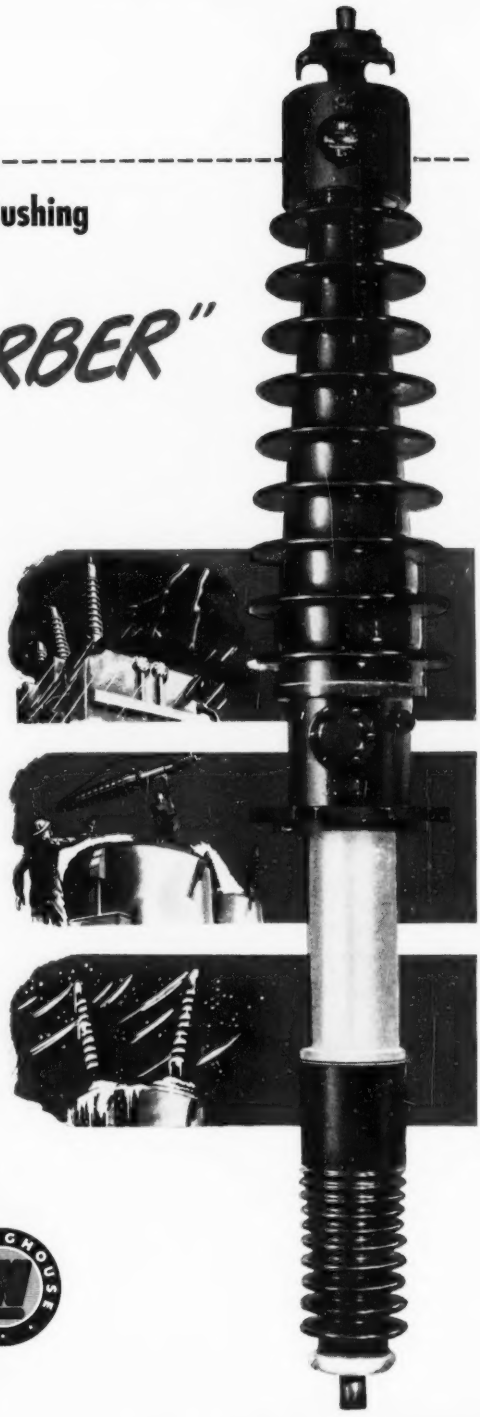
YOU CAN BE **SURE**.. IF IT'S

Westinghouse

## Type "O" Condenser Bushing

# 3 WAY "SHOCK ABSORBER"

### FOR POWER CIRCUIT BREAKERS AND POWER TRANSFORMERS



**ELECTRICALLY** . . . Insulation of the highest quality is provided in the condenser, which is completely impregnated with degassed oil, hermetically-sealed and cushioned with dry nitrogen to insure continued low internal loss and radio-influence voltage.

**MECHANICALLY** . . . Springs in the cap keep pressure on the gaskets at all times. The porcelains are one piece. Bushing construction is strong mechanically.

**THERMALLY** . . . Because of its excellent design—electrically and mechanically—the Type "O" Bushing is not affected by heat or cold. Internal losses do not increase appreciably over the temperature ranges encountered in transformers or circuit breakers.

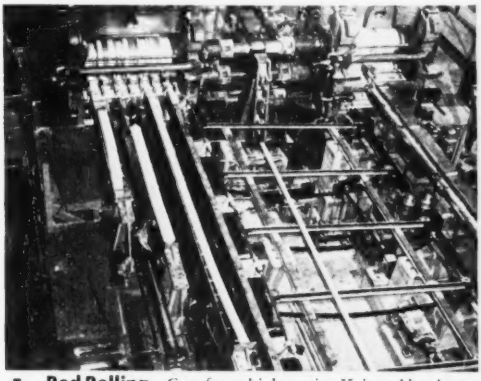
Greater electrical, mechanical and thermal strength add up to increased safety for your system. All the facts on the Type "O" Bushing are available from your nearby Westinghouse representative. Ask him for Booklet B-3462, or write Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pennsylvania. Also ask for information about circuit breakers and transformers equipped with Type "O" Bushings. J-60711

Westinghouse

**POWER CIRCUIT BREAKERS**
**POWER TRANSFORMERS**

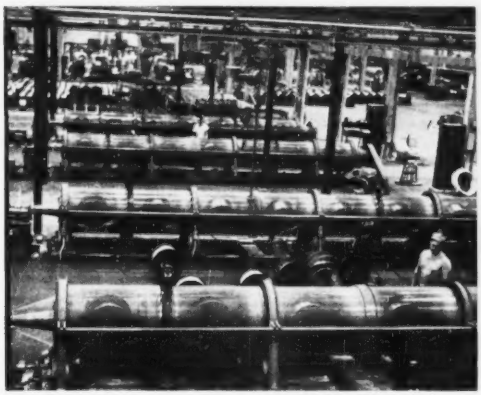
# Why you can depend on Kaiser Aluminum Conductor

You're sure of dependable supplies of Kaiser Aluminum Conductor—because Permanente Metals' fully integrated production includes all this under one roof at centrally located Newark, Ohio:



**1. Rod Rolling**—Cast from high purity Kaiser Aluminum pig from Permanente Metals' two reduction plants, ingots pass through breakdown mills to become rods for wire drawing.

**2. Drawing**—On the most modern equipment in the aluminum electrical conductor industry, Kaiser Aluminum rod is drawn into wire. Here it passes through a series of ten dies.



**3. Stranding**—Manned by experienced, highly skilled personnel, cable stranders for Kaiser Aluminum electrical conductor spin at high speed. Finished conductor emerges at the left.

**4. And the most valuable asset of all:** Knowledge of your conductor problems, and the ability to send your shipment of Kaiser Aluminum Conductor out on time.

Do you need aluminum conductor? To take advantage of early delivery schedules, contact any office of Permanente Products' nationwide sales organization.

**Permanente Metals**

PRODUCER OF

**Kaiser Aluminum**

**CONDUCTOR**

SOLD BY PERMANENTE PRODUCTS COMPANY, KAISER BUILDING, OAKLAND 12, CALIFORNIA . . . WITH OFFICES IN: Atlanta • Boston • Chicago • Cincinnati • Cleveland • Dallas • Denver • Detroit • Houston • Indianapolis • Kansas City Los Angeles • Milwaukee • Minneapolis • New York • Oakland • Philadelphia • Portland, Ore. • Seattle • Spokane • St. Louis • Wichita

*Also available through General Electric Supply Corporation, Westinghouse Electric Supply Company, and Line Material Company.*

# Nicopress SUSPENSION DEAD END

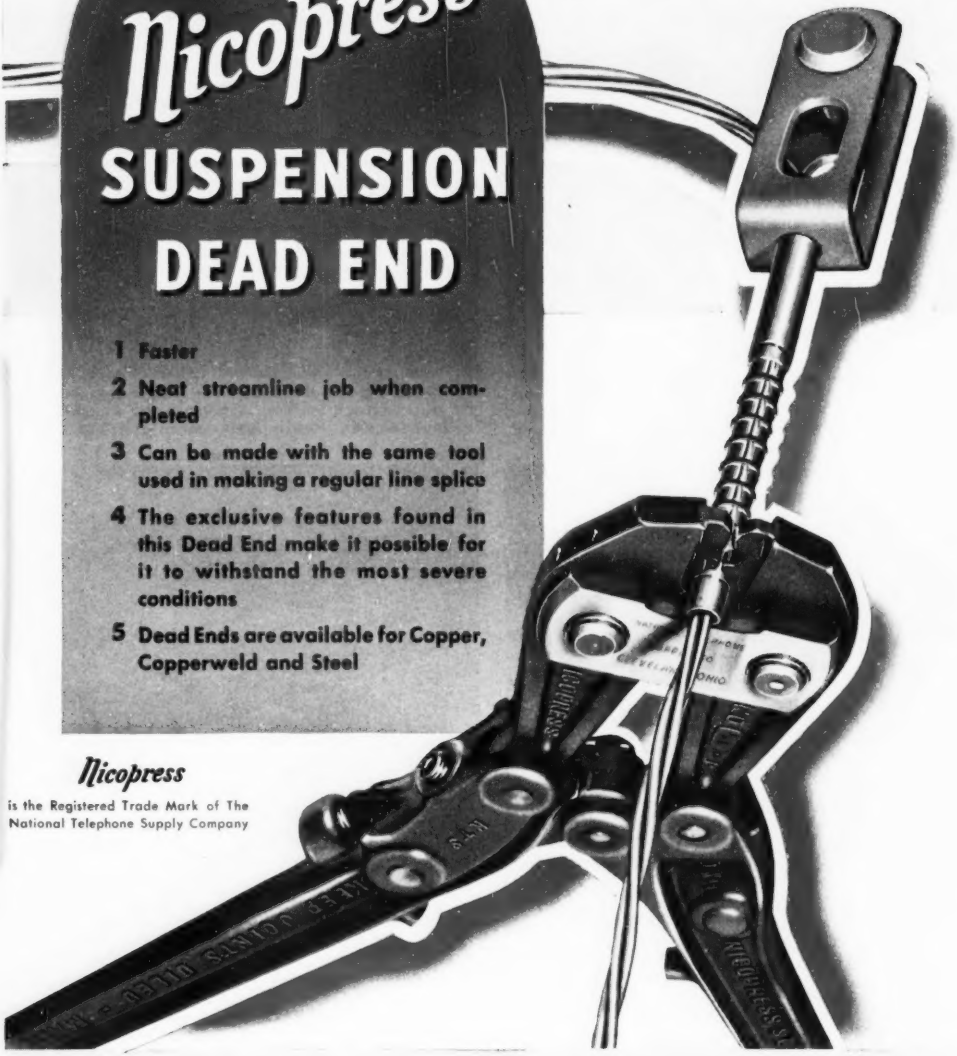
1 Faster

2 Neat streamline job when completed

3 Can be made with the same tool used in making a regular line splice

4 The exclusive features found in this Dead End make it possible for it to withstand the most severe conditions

5 Dead Ends are available for Copper, Copperweld and Steel



*Nicopress*
is the Registered Trade Mark of The National Telephone Supply Company

## The National Telephone Supply Company

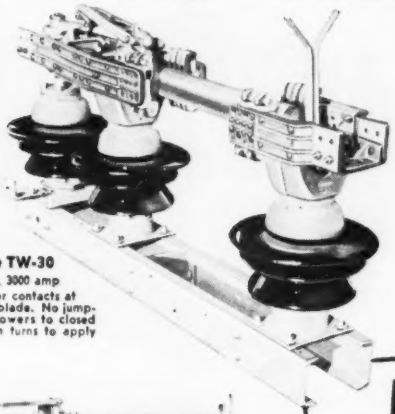
**5100 SUPERIOR AVENUE • CLEVELAND 3, OHIO**

*Canadian Mfr.:* N. SLATER CO., LTD., HAMILTON, ONTARIO, CANADA

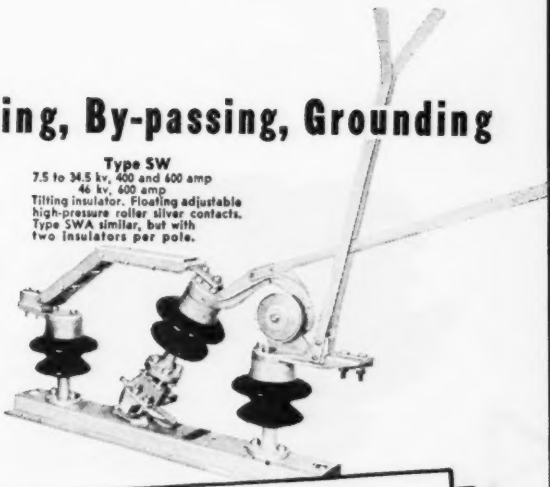
*Export Distributor:* INTERNATIONAL STANDARD ELECTRIC CORP., NEW YORK, N. Y.

# Outdoor High-Voltage
# SWITCHES
## 7.5 to 230 kv

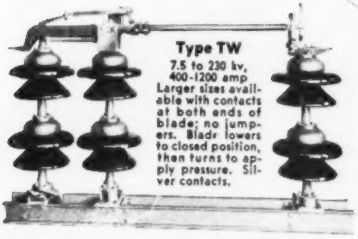
## Disconnecting, Sectionalizing, By-passing, Grounding



**Type TW-30**
7.5 to 34.5 kv, 3000 amp
Multiple silver contacts at both ends of blade. No jumpers. Blade lowers to closed position, then turns to apply pressure.



**Type SW**
7.5 to 34.5 kv, 400 and 600 amp
46 kv, 600 amp
Tilting insulator. Floating adjustable high-pressure roller silver contacts. Type SWA similar, but with two insulators per pole.



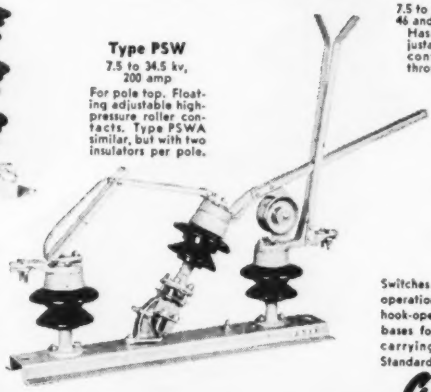
**Type TW**
7.5 to 230 kv, 400-1200 amp
Larger sizes available with contacts at both ends of blade; no jumpers. Blade lowers to closed position, then turns to apply pressure. Silver contacts.

## Easy to Install, Easy to Operate, Special Ice-breaking Features

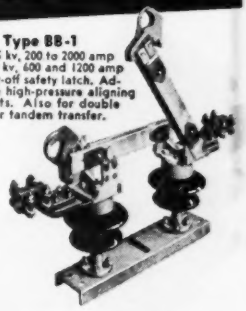
**Upright, vertical, or underhung mountings for three- or six-pole group operation (except Type BB-1).**

**Type YVW**
46 to 115 kv, 600 and 1200 amp
For limited space. Two rotating insulators. Both half-blades swing to same side. Self-aligning silver contacts.

**Type PSW**
7.5 to 34.5 kv, 200 amp
For pole top. Floating adjustable high-pressure roller contacts. Type PSWA similar, but with two insulators per pole.



**Type BB-1**
7.5 to 34.5 kv, 200 to 2000 amp
46 and 69 kv, 600 and 1200 amp
Has pry-off safety latch. Adjustable high-pressure aligning contacts. Also for double throw or tandem transfer.



***43 Years of Specialized Experience***

For 43 years the Pacific Electric Mfg. Corporation has specialized in the design and manufacture of high-voltage switching equipment. Major types of air-break switches are shown here. Other outdoor equipment includes oil circuit breakers, fuse cutouts and bus fittings.

All through the years, repeat orders from power companies everywhere testify that this equipment is properly engineered for the job.

Switches shown are single-pole units for group-operation by mechanism, except Type BB-1 which is hook-operated. All outdoor type. Mounted on rigid bases for perfect alignment. Nonferrous current-carrying parts. NEMA and AIEE Adopted Standards.

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K&M has over 50 years of knowledge and experience in this field, to focus on any problem of yours where an asbestos textile can better your product. Consult us.

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# HEAT-POWERED WITH NICHROME*V

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Housed in a cylindrical shell, the furnace is mounted with practically line contact on a base containing instruments and controls—a type of construction that permits the base to remain at almost room temperature, with instruments and controls easily accessible at all times.

Operating temperatures from 900°F. to 1850°F. are obtainable —precisely controlled by means of a manually operated 36-step, tap-changing transformer.

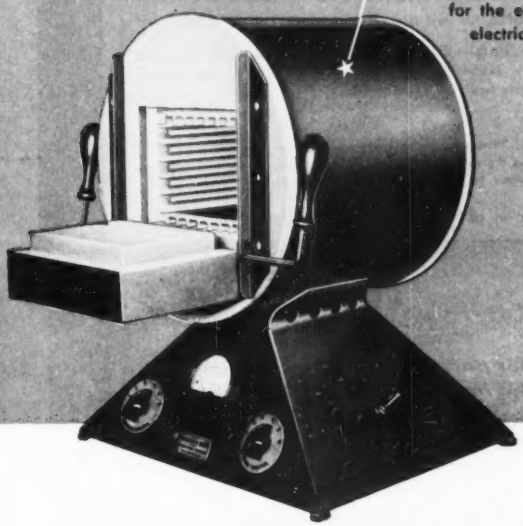
Outstanding characteristics of this new type furnace are rapid heating (about 85 minutes from cold to maximum temperature), and quick response to demand for temperature change.

To assure heating elements that will "stand the gaff" and give top-level performance under such punishing conditions, Hevi Duty Electric Company uses high heat- and corrosion-resistant Nichrome V. The absolute uniformity of this superior alloy assures even heat distribution; its retention of physical and electrical properties at high temperatures, enables critical adjustments to be made and maintained; its resistance to thermal shock assures long life, completely dependable and economical service.

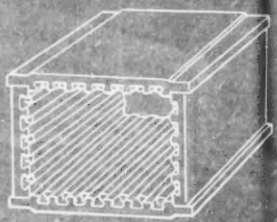
Whatever your electrical resistance problem, consult with us. In addition to world-famous Nichrome V and Nichrome, we make over 80 alloys for the electrical and electronic industries—the most complete line of electrical resistance alloys in the world.

**New Model 851 Hevi Duty Muffle Furnace**

Standard for use on 115 v. or 230 v., 50 to 60 cycles, A.C. Input: 1150 watts. Maximum operating temperature: 1850°F. 36-step control down to approximately 900°F. Heating elements: 22 gauge Nichrome V wire.



Heating units, top and bottom, are interchangeable; likewise, the two side units. All units are easily replaceable and reversible (permitting the coiled Nichrome V wire to be exposed or muffled).



**NOTE:** Nichrome V elements are also used in standard model, industrial Hevi Duty furnaces designed for operation up to 2000°F.

*Nichrome is manufactured only by

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# Triangle's "TRIOPRENE"

High Performance Neoprene Jacketed Cable

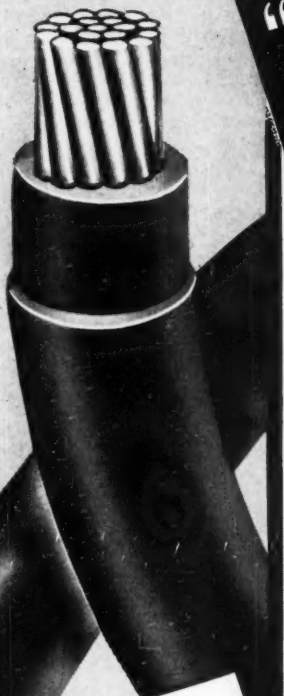
*for*

## DIRECT BURIAL...DUCT SYSTEM ...AERIAL INSTALLATIONS

**that are**

**More Flexible . . . Lighter . . . Longer Lasting . . . Easier to Handle**

***— at substantial savings in cost!***



**I.P.C.E.A. TYPE RR . . .**
**U.L. TYPE USE**

"Trioprene" Parkway Cable, Type RR, is available in sizes from No. 14 to 500,000 C.M., for operating potentials up to 5,000 volts. "Trioprene" Underground Service Entrance Cable, Type USE, is made in sizes from No. 14 to 500,000 C.M., for potentials up to 208 volts to ground.

Here's what Triangle's "Trioprene" special cable means to you:

- **Greater Flexibility.** No metal tapes, no lead sheath, no confining braid — just f-l-e-x-i-b-l-e rubber insulation, f-l-e-x-i-b-l-e "Trioprene" jacket!
- **Smaller Diameter.** Elimination of customary layers of tape, braid and armor saves space — with no sacrifice of protection!
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- **Non Magnetic.** No steel is used in "Trioprene" jacketed cables.
- **Easier Handling — Easier Splicing.** You don't have to wrestle with "Trioprene" cables! Because they are lighter, smaller, more flexible — they handle as easily as building wire.

. . . and in addition . . .

- **Lower Cost.** Where economy must be achieved with no sacrifice of quality, compare the cost of the cable, the freight, the labor for installing — then "Trioprene" jacketed cables are the answer!

**For EXTRA quality — at NO extra cost — insist on "TRIOPRENE"!**

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**1900 Jersey Avenue • New Brunswick, N. J.**

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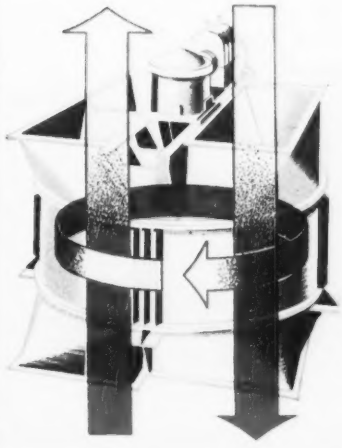
# Fact File on Preheat

No. 4

The free area of the gas and air passages through the Ljungstrom heating elements is maintained at design levels by a simple cleaning routine, accomplished during operation.

A high-velocity jet built in the cold end of the unit moves radially across the rotor elements, cleaning them of soot or fly ash. In service — as in design — our engineers apply for your benefit 26 years of experience gained at Ljungstrom-equipped plants.

LJUNGSTROM



The Ljungstrom Air Preheater is a compact gas-to-air or gas-to-gas heat exchanger, operating on a continuous regenerative counterflow basis. Hundreds of leading power plants and other special applications confirm its high level of heat recovery and long-term low maintenance service.

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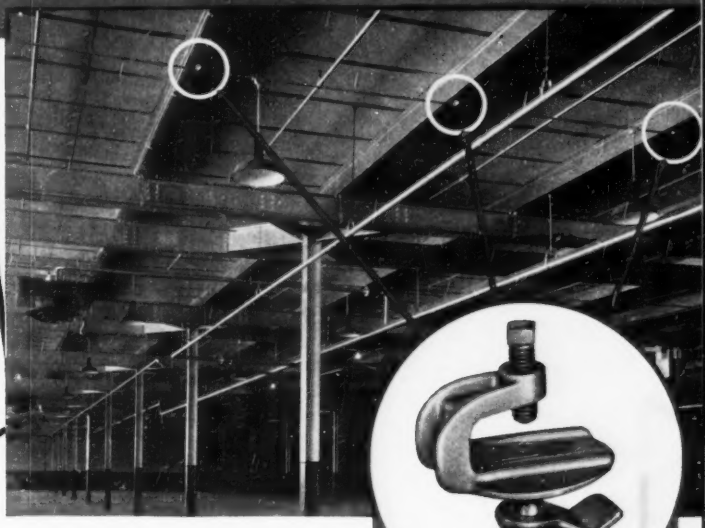
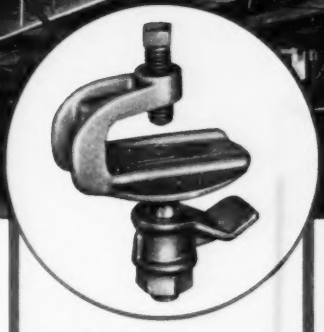
## with APPLETON "STA-TITE" Pipe Hangers





Type "PHS" for use with single conduit.

## *Firmly, Permanently Grip Both Rigid and Thin Wall Conduit!*

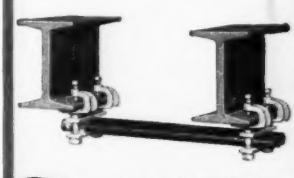
For ruggedly dependable performance under the most severe service conditions, standardize on Appleton "Sta-Tite" Pipe Hangers.

Easy installation of these sturdy pipe hangers is assured by clean threading, smooth finish, expert over-all design.

Made of tough Malleable Iron in Appleton's own foundries and fabricating plants, "Sta-Tite" Pipe Hangers speed and simplify complex jobs—enable you to run conduit parallel to the beam, at right angles or at any angle in between.

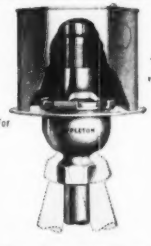
Whatever the wiring requirement, you'll find the exact fitting you need in the 15,000-item Appleton Line. For faster completion of better jobs, specify Appleton—STANDARD FOR BETTER WIRING.

Type "PHD" with two conduits parallel with structural shape.



Type "PH" with strips for suspending groups of pipe from structural shapes.

### APPLETON SAFETY SWIVEL HANGERS

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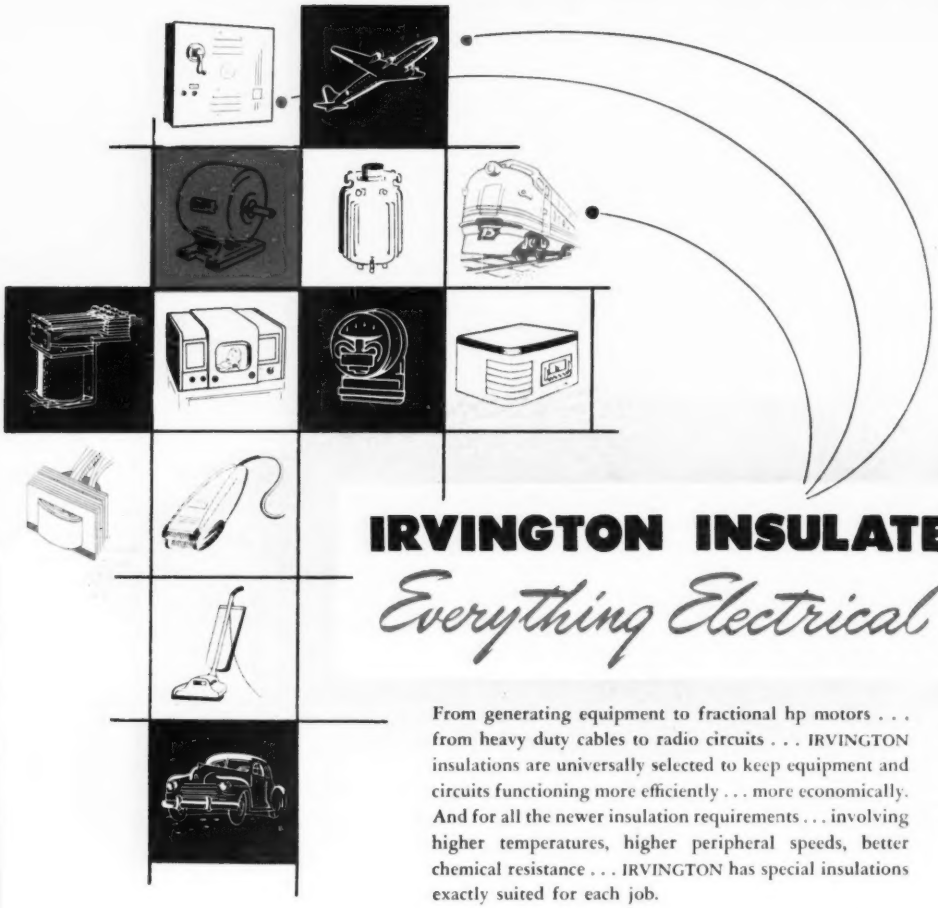

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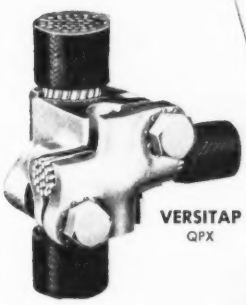

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QPX

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SERVIT
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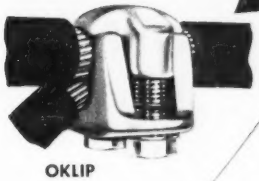
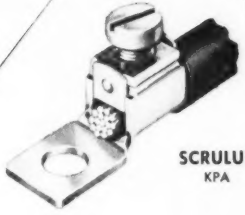
## HERE'S WHY



OKLIP
KVS



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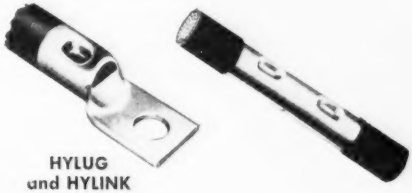

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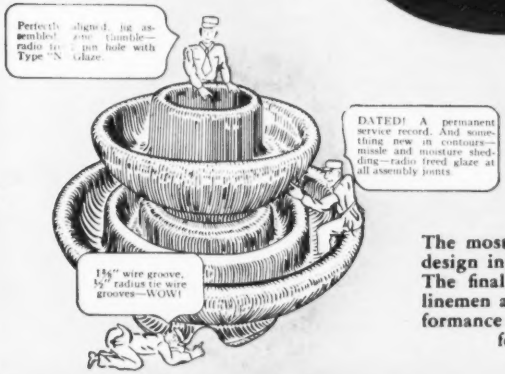
**The answer to John Lineman's Prayer.**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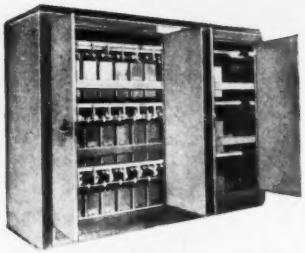
## POWER-FACTOR CAPACITORS



Interior view of a 900 Kvar rack, consisting of 66, 15 Kvar individual C-D capacitors, for operation on a 575 volt, 3 phase, 60 cycle circuit.

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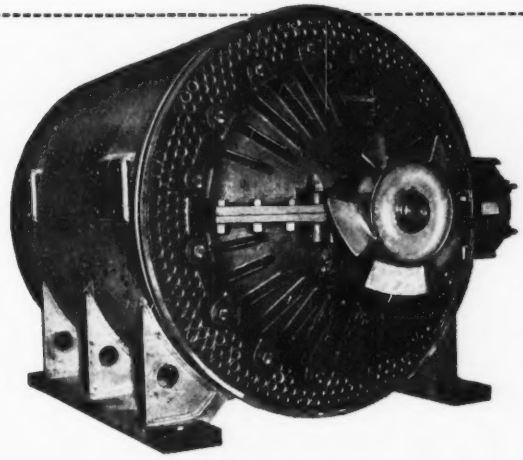
Reg. U. S. Pat. Off.

*C-D Best by Field Test!*

CORNELL-DUBILIER WORLD'S LARGEST MANUFACTURER OF CAPACITORS

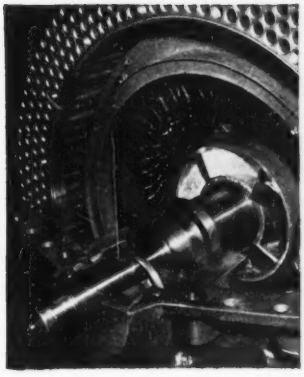
# ANACONDA copper tubes in stator yoke solve explosion-proof motor design problem

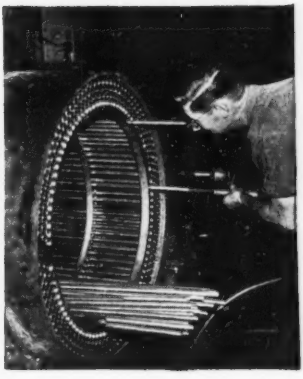


**Getting rid of heat** has always been a major problem in motor design. But in an explosion-proof motor that problem is really tough. The cooling system developed in the new 400-hp. 2300-volt Allis-Chalmers Explosion-Proof Tube-Cooled Motor, shown here, solved the problem neatly. It is entirely self-contained. Requires no water flow. Contains no inert gas. Just air.

Rapid, adequate heat transfer is effected by circulation of the sealed air. Cooling air is continuously forced through the copper heat transfer tubes mounted in the stator yoke. Simple, efficient, dependable.

Good ideas and the right materials can give alert manufacturers a big competitive advantage. ANACONDA Copper and Copper Alloys—and the experience of ANACONDA technicians—help solve many critical design problems in the electrical industries. May we help solve yours? Tell us about it. Your inquiry will be handled promptly, competently and confidentially by our Technical Department. Please address The American Brass Company, Waterbury 20, Connecticut. In Canada: Anaconda American Brass Ltd., New Toronto, Ont.





**400-hp. 2300-volt explosion-proof motor designed and built by Allis-Chalmers Manufacturing Company. Internal fans on the rotor shaft circulate sealed air around the ANACONDA Copper cooling tubes shown here. At the same time, room air is forced through the tubes by an external fan mounted on one end of the rotor shaft. Thus internal heat is rapidly, effectively and safely dissipated.** 49131

For copper and its alloys . . consult **ANACONDA**

YOU CAN BE **SURE**.. IF IT'S

Westinghouse

PROOF

FROM

CALIFORNIA

# "500 transformer years of service convince us 'CSP' is better"

The record is clear and complete in this case history of the way "CSP"* transformers practically eliminated outages for twelve years.

The facts are these:

In 1932, the utility built a line to a neighboring town some 40 miles distant, using conventional-type transformers. The next four years were plagued with service calls to this line because of both lightning and overload outages.

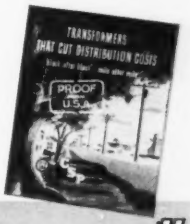
In 1936, two "CSP" transformers were installed in an effort to find a way to halt the mounting service costs. So successful were these two installations that additional "CSP" units have been added each year, until now over 500 transformer years of service, with only one transformer failure, have proved the worth of Westinghouse "Completely Self-Protecting" transformers.

This much is sure: The *built-in* protection of "CSP" transformers reduces outages on both lightning and overload. Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pennsylvania. J-70527

**Trademark—Reg. U. S. Pat. Off.*

*WANT MORE FACTS?* Here are 36 pages of product information you'll want to have about Completely Self-Protecting transformers. Covers construction, operation, mounting and servicing. Ask for B-4249.

*Call the Westinghouse Salesman*




WESTINGHOUSE

**Westinghouse "CSP" TRANSFORMERS**

**SINGLE PHASE** **THREE PHASE** **BANKED SECONDARY**

# *New Day-Brite Four-by-Four Unit Wins High Acclaim*

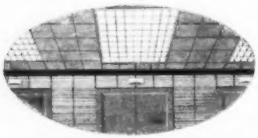
Architects, lighting engineers and contractors, and users have enthusiastically approved Day-Brite's new Four-by-Four Unit. Unlimited architectural possibilities, flexibility of application, and advanced integrated lighting efficiency are only a few of the reasons for a wave of orders.

**FOR OFFICES**

Four-by-Four Units are engineered for both recessed and surface mounted applications. Plaster frames are available for use when fixtures are recessed.

**LARGE DEPARTMENT STORES**

Units are 48″ square and 9″ deep. Fixtures can be used with six, eight, or ten 40-watt fluorescent lamps. Knockouts are provided for feed connections.



**ENTRANCES, LOBBIES**

Exclusive Day-Brite BOXCO louver assembly has double-wall louvers interlocked for extreme strength and rigidity. Fixtures are rust-inhibited and finished in HOT-BONDED SUPER-WHITE enamel.

**SMALL RETAIL STORES**

Separable hinges on two sides of the louver assembly allow easy servicing. In fact, every component part of the unit is *specifically* engineered for simple, quick maintenance.

*Alameda Road Shop, Singer Sewing Machine Company, Kansas City, Mo.*

*For example:*

## SINGER SEWING MACHINE IN KANSAS CITY "DRESSES UP" WITH FOUR-BY-FOURS . . .

Day-Brite Four-by-Four units, recessed into an acoustical ceiling provide a high level of cool, glareless light in Singer's Alameda Road Shop.

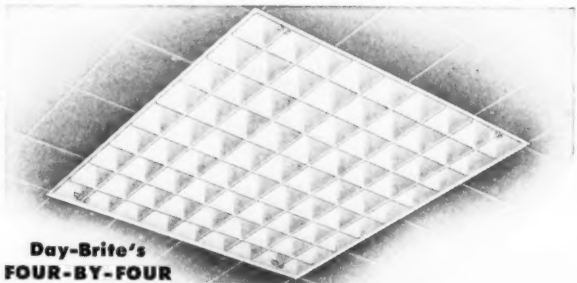
This well-distributed general lighting combines with accent lighting to point up merchandise to best advantage. Architecturally, the ceiling pattern is interesting but unobtrusive . . . attractive and smart.

Today . . . learn more about this new lighting development, its handsome appearance . . . its amazing ease of maintenance. See for yourself how Day-Brite's Four-by-Fours answer your particular lighting problem. Write now for Bulletin 20-C.

Day-Brite Lighting, Inc., 5425 Bulwer Avenue, St. Louis 7, Mo. In Canada: Amalgamated Electric Corp., Ltd., Toronto 6, Ontario.

IT'S EASY TO SEE WHEN IT'S
**DAY-BRITE** *Lighting*

**DISTRIBUTED NATIONALLY BY LEADING ELECTRICAL WHOLESALERS**



**Day-Brite's FOUR-BY-FOUR**
**setting a new trend in lighting . . .**

359

# Vaportight CONDULETS*

## for electrical installations that are exposed to **weather, moisture, steam or non-combustible dusts**

**JUNCTION CONDULETS - SWITCHES - RECEPTACLES - LIGHTING FIXTURES - CIRCUIT BREAKERS - PANELBOARDS**

**The illustrations show a representative selection from the hundreds of CONDULETS that are vaportight or when furnished with covers and gaskets become vaportight.**

*CONDULET is a coined word registered in the U.S. Patent Office. It designates a product made only by the Crouse-Hinds Company.

Type X Obround Condulet with Blank Cover and Gasket
Type FSC Condulet with Blank Cover and Gasket
Type GSC Condulet with Blank Cover and Gasket
Type CRT Vaportight Condulet
Type C Obround Vaportight Switch Condulet
Type FS Vaportight Triple Switch Condulet
Type FSC Vaportight Push Button Station Condulet
Type FSC Vaportight Plug Receptacle Condulet
Type VPH Vaportight Indirect Lighting Condulet 150 – 200 Watt
Type AHC Vaportight Flexible Fixture Hanger
Type FS Vaportight Switch Condulet
Type FD Vaportight Switch Condulet
Type FDC Vaportight Switch Condulet
Type FS Two Gang Vaportight Switch Condulet
Type FS Vaportight Lighting Fixture
Type FSC Two Gang Tandem Condulet with Vaportight Switch and Plug Receptacle
Type VDB Vaportight Lighting Condulet 300 – 500 Watt
Type FCP Three Gang Vaportight Panel Mounting Condulet with Pilot Lights and Switch
Type VGH Vaportight Lighting Fixture for CRH Series Condulets
Type GS Vaportight Lighting Fixture for GS Series Condulets
Type VG Vaportight Lighting Condulet
Type GS Vaportight Lighting Fixture for GS Series Condulets
Type VDA Vaportight Lighting Condulet with Dome Reflector 100 – 200 Watt
Type FSC Two Gang Vaportight Combination Push Button Station and Pilot Light Condulet
Type V Vaportight Lighting Condulet for Mounting on Machines
Type V Vaportight Heavy Duty Lighting Condulet with Shatterproof Globe
Type VDA Vaportight Tank or Vat Light Condulet
Type ARC Vaportight Lighting Fixture for Obround Condulets.
Type VC Vaportight Lighting Condulet
Type VDA Vaportight Lighting Condulet
Type VHA Vaportight Lighting Condulet with Flush Hubs
Type VR Vaportight Lighting Condulet for Mounting on a Hand Rail
Type VRJ Vaportight Lighting Condulet for Extensions from Concealed Conduit
Type VS Vaportight Hand Lamp with Rubber Handle
Type V Vaportight Lighting Condulet with Dome Reflector 100 – 200 Watt
Type RCB-8 Vaportight Lighting Fixture for Wall Mounting
Type VFC Vaportight Gauge Lighting Condulet*
Type VV Vaportight Lighting Condulet with Fresnel Lens
Type VJ Vaportight Lighting Condulet
Type VLG Vaportight Gauge Lighting Condulet Fluorescent
Type VDA Vaportight Lighting Condulet with Angle Reflector 100 – 200 Watt
Type 15W Vaportight Circuit Breaker Condulet
Type DVSP Dust Tight and Vaportight Panelboard
Type DVSP Dust Tight and Vaportight Panelboard
Type DLP Dust Tight and Vaportight Panelboard

**A Nationwide Distribution Through Electrical Wholesalers**

## CROUSE-HINDS COMPANY
### Syracuse 1, N. Y.

*Offices:* Birmingham — Boston — Buffalo — Chicago — Cincinnati — Cleveland — Dallas — Denver — Detroit — Houston — Indianapolis — Kansas City — Los Angeles — Milwaukee — Minneapolis — New York Philadelphia — Pittsburgh — Portland, Ore. — San Francisco — Seattle — St. Louis — Washington. *Resident Representatives:* Albany — Atlanta — Baltimore — Charlotte — New Orleans — Richmond, Va.
CROUSE-HINDS COMPANY OF CANADA, LTD., *Main Office and Plant:* TORONTO, ONT.

**CONDULETS • TRAFFIC SIGNALS • AIRPORT LIGHTING • FLOODLIGHTS**

# He finds trouble by ear

As this cableman runs his pickup coil along the cable, his ear tells him when he has hit the *exact spot* where unseen trouble is interfering with somebody's telephone service.

Trouble develops when water enters a cable sheath cracked perhaps by a bullet or a flying stone. With insulation damaged, currents stray from one wire to another or to the sheath. At the telephone office, electrical tests on the faulty wires tell a repairman approximately where to look for the damage.

A special "tracer" current, sent over the faulty wires, generates a magnetic field. Held against the sheath, an exploring coil picks up the distinctive tracer signal and sends it through an amplifier on the man's belt to headphones. A change in signal strength along the cable tells the exact location of the "fault."

Compact, light, simple to use, this test set makes it easier for repairmen to keep your line in order. It is another example of how Bell Laboratories research helps make Bell Telephone service the most dependable in the world.

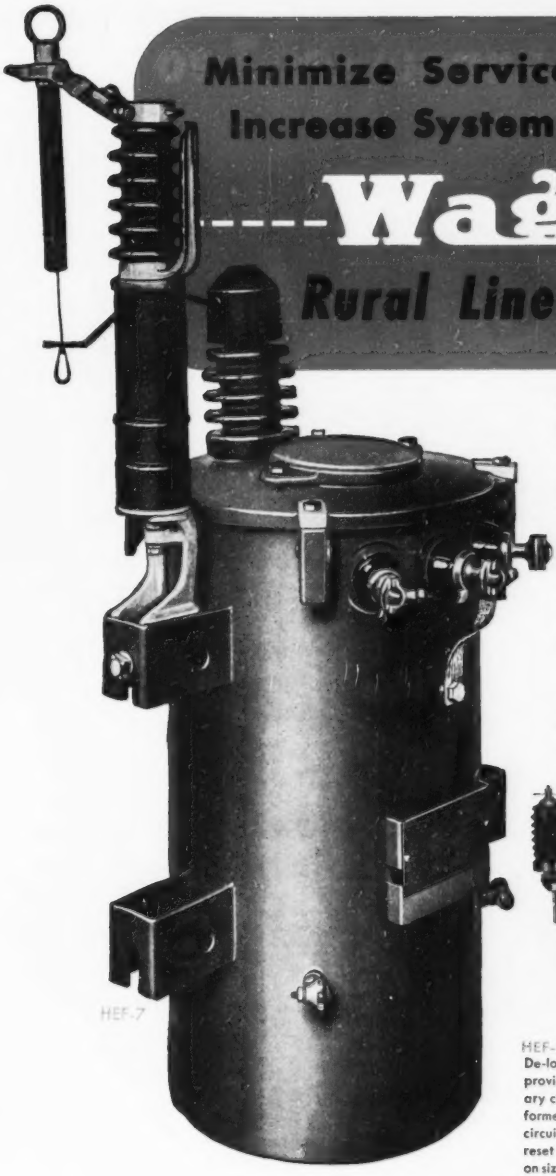
**BELL TELEPHONE LABORATORIES**

Exploring and inventing, devising and perfecting, for continued improvements and economies in telephone service.

# Minimize Service Interruptions—Increase System Efficiency—*Install*

# Wagner

## Rural Line Transformers



HEF-7

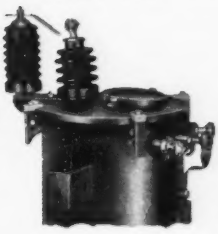
On all types of rural lines you will find Wagner Transformers serving dependably and providing the utmost in safety and system efficiency.

Three popular types of Wagner Rural Line Transformers are illustrated. Each is provided with the protective equipment to best suit the needs for which it is designed.

Type HEF-7, illustrated at left, has a Joslyn Lightning Arrester to provide surge protection and a primary overload limiter link which is an "extended range" link that withstands momentary surges even in fractional ampere ratings, yet protects the transformer against harmful overloads and secondary faults. A blown fuse can be quickly replaced, reducing the time required to put the transformer back in service.

Wagner manufactures a complete line of Rural Line, Power, Distribution, and Unit Substation Transformers. Twenty-nine branches, located in principal cities, provide nationwide service facilities.

Types HEF-3 and HEF-5 are described below. Write for Bulletin TU-1C for complete information on Wagner Rural Line Transformers. Address Wagner Electric Corporation, 6456 Plymouth Ave., St. Louis 14, Mo., U. S. A.



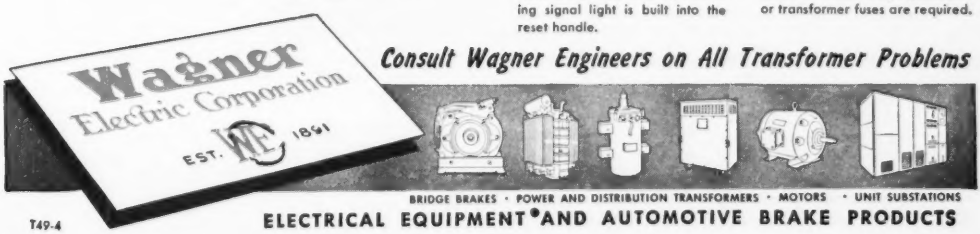
HEF-3

De-Ion Gap on high-voltage side provides surge protection; secondary circuit-breaker protects transformer against secondary short-circuits and overloads. Breaker reset handle is easily accessible; on sizes 5-kva and above, a warning signal light is built into the reset handle.

HEF-5

Double "bird-proof" gap provides surge protection; internal fuse forms a protective link between the transformer and the high voltage line. When the double gap and internal fuse are combined no other surge protection or transformer fuses are required.

*Consult Wagner Engineers on All Transformer Problems*




BRIDGE BRAKES • POWER AND DISTRIBUTION TRANSFORMERS • MOTORS • UNIT SUBSTATIONS

T49-4

**ELECTRICAL EQUIPMENT • AND AUTOMOTIVE BRAKE PRODUCTS**

# Johns-Manville Announces Two New

*Smooth layers of Quinterra Type 6 Electrical Insulation (Twin-ply), used in winding a dry-type transformer*

# Quinterra

**TYPE 6 (TWIN-PLY)**

## A new cost-reducing, high-temperature insulation that prolongs transformer life many times through its resistance to pyrolysis

Here is a radically new asbestos-base, continuous-sheet, paper-like electrical insulation that offers many economies. It is primarily intended for interlayer and wrapper insulation in windings and coils used in Class A and B transformers (internal hot-spot temperatures 130C, or higher if special varnishes are employed).

Quinterra Type 6 is plied at the factory by welding two layers of Quinterra and calendering them into a dense, strong and smooth-surfaced insulation having good tensile and bursting strengths. For economical application with a minimum of waste, Quinterra Type 6 is furnished in continuous rolls cut to exact widths.

**Excellent handling properties**

Uniformity of physical and handling properties enables assemblers to achieve production rates such as are attained with the best types of interlayer and wrapper insulations. Further economies result from the large square-foot-per-dollar coverage.

**Excellent constructional advantages**

The plied construction of Quinterra Type 6 offers two distinct constructional advantages: (1) It provides better dielectric protection than a single layer. (2) Under stress, the weaving strains within coil structures are less likely to damage a plied insulation than a single-layer insulation.

**Excellent dielectric-thermal characteristics**

The base sheets of all Quinterra products are made 100% inorganic, but, for mechanical reasons only, are saturated with an organic resin. At room temperature (ASTM conditions) Quinterra Type 6 averages in excess of 350 VPM. After prolonged exposure at 175C, long after the thermoplastic saturant is driven off, it still maintains its original dielectric strength and requires only the re-establishment of its varnish protection to provide a further useful life cycle.

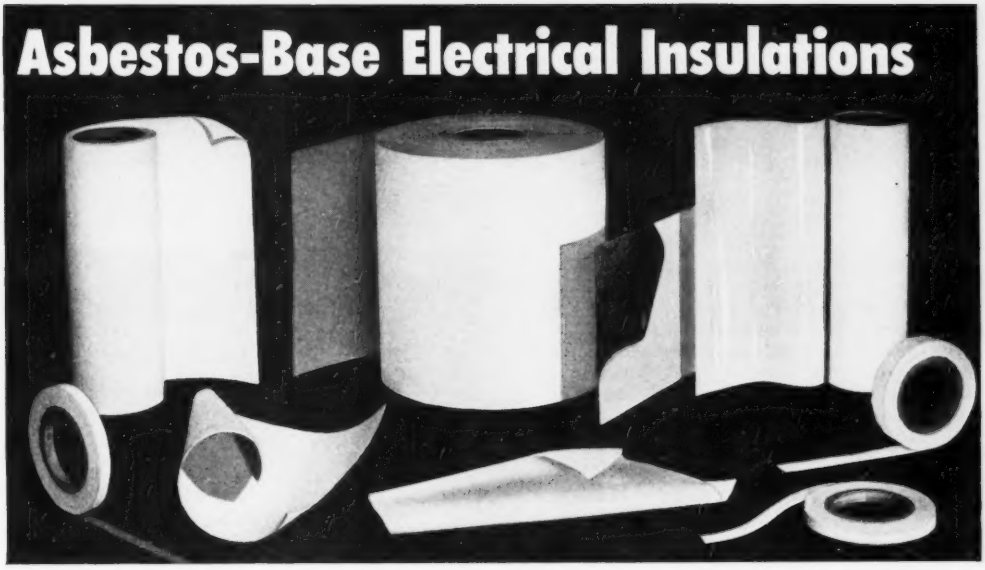
We will be glad to provide you with samples and further information about Quinterra Type 6 Electrical Insulation. Write Johns-Manville, Box 290, New York 16, N. Y.

**Weights and thicknesses of Quinterra Type 6**

| Thickness ± 10% | Weight Per 100 sq ft ± 15% | Approx Coverage sq ft lb |
|---|---|---|
| .0045" | 2.5 | 40 |
| .006" | 3.3 | 33 |
| .007" | 3.8 | 26 |
| .008" | 4.5 | 22 |
| .009" | 4.8 | 20 |
| .010" | 5.5 | 18 |
| .012" | 6.2 | 16 |
| .015" | 7.2 | 14 |

**Johns-Manville**

# Asbestos-Base Electrical Insulations



*A variety of types of electrical insulations as produced by combining glass, mica, and organic papers and films with Quinorgo #3000 or #4000.*

# Quinorgo

**#3000 AND #4000**

## New, economical, high-temperature insulations with a previously unattainable combination of dielectric and mechanical properties

Quinorgo #3000 and Quinorgo #4000 are two new insulations developed by Johns-Manville. Each can be used alone or in combination with other dielectrics. In the latter use they can be either treated or coated with insulating varnishes, or combined with organic or inorganic electrical insulating sheets or films.

Quinorgo insulations contain 80% or more of specially processed asbestos fiber, the remainder being selected organic fibers and binders. The two types differ in that the organic portion of Quinorgo #4000 contains a small amount (3% or less) of resin not present in Quinorgo #3000. The resin slightly reduces absorption and penetration.

These highly improved forms of asbestos electrical insulations have extreme uniformity of texture and caliper (from .005" to .015"). They are furnished in continuous rolls, in tapes of exact widths and in sheets cut to size.

**Excellent for compactness** — Quinorgo #3000 and #4000 have important advantages where asbestos papers previously could not be used because they were too thick, their dielectric too low, or strength inadequate.

**Excellent for "composites"** — Quinorgo #4000, because of its heat resistance, closed nonwoven structure, uniform thickness and special penetration characteristics, is ideal for use in composite insulations.

For example, it may be coated on one surface with shellac or varnish to permit bonding or cementing to it such mechanically or dielectrically stronger materials as inorganic woven cloths and mica or organic cellulose films or sheets. The opposite surface remains ready for absorption of treating varnishes used in the further processing of equipment after the composite insulation has been applied.

**Excellent for economies**—Quinorgo #3000 and #4000 may be economically substituted for quality grade organic or inorganic layer insulation. When varnish-protected in apparatus, they will perform indefinitely because of their high asbestos content. (Hot-spot temperatures to 130C).

We will be glad to provide you with samples and further information about Quinorgo insulations. Write Johns-Manville, Box 290, New York 16, N. Y.

**General average properties of Quinorgo #3000 and #4000**

| Thickness | Lbs Per 100 sq ft | 1" wide Longitude T.S. lbs | Dielec Min VPM |
|---|---|---|---|
| | 3000-4000 | 3000-4000 | 3000-4000 |
| .005" | 1.5 1.7 | 14 15 | 300 |
| .007" | 2.2 2.5 | 18 19 | 300 |
| .010" | 3.3 4.0 | 20 21 | 250 |
| .015" | 4.7 5.7 | 26 28 | 200 |

Electrical Insulations

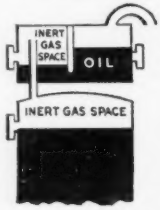
JOHNS MANVILLE JM PRODUCTS

# Four Reasons for

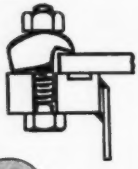
TWO WAYS to increase the return on your transformer investment are to reduce rate of depreciation and trim maintenance costs. These objectives are accomplished in Allis-Chalmers power transformers with features like those below. These four features, when added together over the life span of the transformer, can make a *big difference* in your power transformer operating costs. Here's why:

## 1 SIMPLE, POSITIVE OIL PROTECTION

*Oil-Sealed* Inert Gas oil protection, introduced by Allis-Chalmers, operates practically without attention. No replenishment of gas containers necessary. Low pressure system (not over 1 lb per sq in.) extends gasket life. Effective oxygen, moisture seal eliminates sludge and acid formation in transformer oil.




## 2 LONGER GASKET LIFE



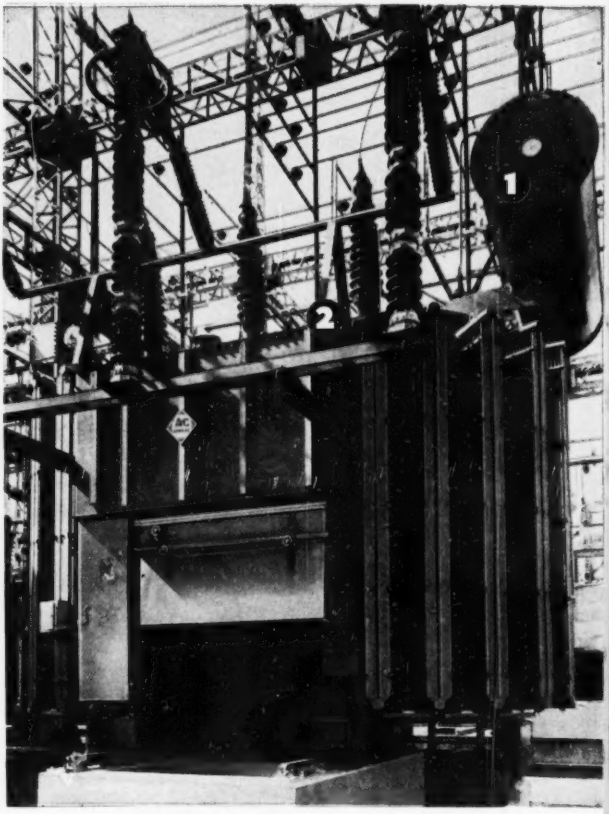
A seemingly small detail like gasketed seals quickly assumes great importance when they fail to function properly and costly maintenance is required. On Allis-Chalmers power transformers, maximum gasket life and effectiveness are *assured* through metal-to-metal controlled gasket compression.

## 3 LOW UPKEEP FOR RADIATORS

Radiators are rigidly braced, grooved for added strength. Surface is protected with bonderized coating, followed by two coats of high quality outdoor paint. When repainting is desired, the job is made easier because radiators have staggered cooling fins.

## 4 SIDE OPERATED TAP CHANGER

It's easier, and takes less time to change taps with Allis-Chalmers No Load Tap changer because of its side-of-tank location. There's no danger of coming in contact with high voltage overhead system. Tap positions are easily read from ground level.



**INTERCONNECTING** three systems at a large Indiana substation, this transformer is rated 24,000/30,000 kva, 3 phase, 138-69-34.5 kv. Since its installation in 1945, two duplicate units have been ordered. Typical Allis-Chalmers low-maintenance construction includes the four features at left.

**ALLIS**

***Pioneers in Power***

# Low Maintenance

IN

## ALLIS-CHALMERS POWER TRANSFORMERS

**ALLIS-CHALMERS TRANSFORMER** and regulator work together, serving an important load in Louisiana oil producing area. Transformer is equipped with four 2½% full capacity taps below normal — regulator supplies ±10% regulation in ⅝% steps.

Again, *Oil-Sealed* Inert Gas Protection and other features at left are a part of the Allis-Chalmers low-maintenance design.

For details on Allis-Chalmers quality transformer construction, contact your nearby A-C sales representative. Or write direct.

A-2852

ALLIS-CHALMERS, 932A SO. 70 ST.
MILWAUKEE, WIS.

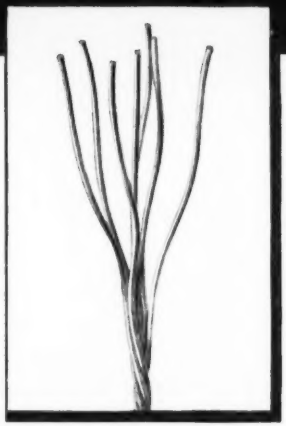
*Oil-Sealed* is an Allis-Chalmers trademark.

# CHALMERS

A-C ALLIS-CHALMERS

***and Electrical Equipment from Generation through Utilization***

# DO IT THE EASY WAY...WITH FORM-SET STRAND



Notice that the strand in the large illustration—Bethlehem Form-Set—has no seizing, yet every wire lies calmly in place. Naturally it is going to slip easily into the fitting—as easily as sliding a pencil into a length of pipe.

But look at that other strand. The wires have bushed out at the ends like a porcupine's quills. Obviously, a seizing job—with consequent loss of time—is required here.

The difference lies in the fact that Bethlehem Form-Set strand is preformed; that is, each wire is given its permanent helical shape before being laid together with its neighbors. Since the wires, after preforming, cannot uncurl, there is no inner wildness or tension; no urge to spring apart. Hence, Form-Set strand doesn't unravel when cut.

Does it cost more? So very *little* extra that the added charge is almost nothing. And for this nominal charge you get the *big* advantages of easier handling and time saved in the field.

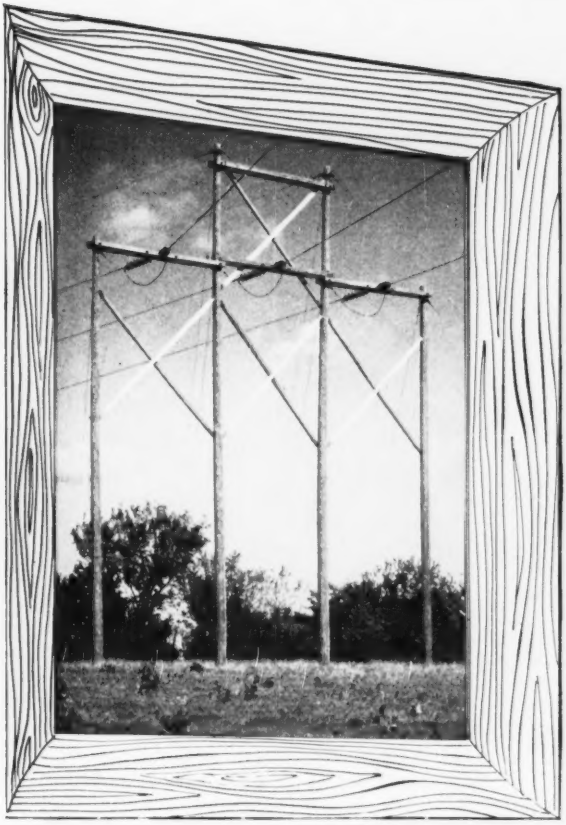
Every inch of Form-Set strand has the ductile bethanized coating—a protective zinc armor applied by Bethlehem's exclusive process. It is available in A, B, and C weights to meet atmospheric conditions in any given area. Full details will be furnished gladly by the Bethlehem man nearest you; call him any time.

BETHLEHEM STEEL COMPANY, BETHLEHEM, PA.

On the Pacific Coast Bethlehem products are sold by Bethlehem Pacific Coast Steel Corporation

*Export Distributor:* Bethlehem Steel Export Corporation

★ BETHLEHEM STEEL ★



Class Two, 50-foot and Class Two, 60-foot Western Red Cedar poles placed in line early in 1944. Treatment was LIFE-SPAN using pentachlorophenol only.

# What's Missing FROM THIS PICTURE?

## You're Right!

**The poles are clean from end to end. They are LIFE-SPAN . . .**

No longer is there any need for additional ground-line protection! The *new, improved* Life-Span, two-immersion treatment does the entire pole-preserving job!

First, a full length immersion in a hot, high toxic solution sterilizes the sapwood, drives out moisture and expands the air in the wood cells. Then, a sudden, complete immersion in a cold bath contracts the expanded air in the wood cells, and creates a vacuum that pulls the pentachlorophenol solution deep into the sapwood. Subsequent diffusion incorporates the *entire* sapwood.

Double concentration of the preservative throughout the three foot ground-line area is insured by incising this portion of the pole. The result is *double* pole protection here, and *completely eliminates* the need for any further, or additional ground-line treatment.

Life Span

**Sold Only by the Following**

**B. J. CARNEY & CO.**
Spokane-Minneapolis

**NAUGLE POLE & TIE CORP.**
Chicago, Illinois

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MINNEAPOLIS
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# LIFE-SPAN POLES

# *MUDDLING* in High Places

It is time for men in Washington and London to stop toying with the problem of international trade. We of the democratic West are at a turning point in our economic affairs. A false step by either the United States or Britain could lead quickly to disintegration of trading between the people of the world as we have known it for the past hundred years. Recent meetings of diplomats in London and Washington have not lifted us out of this danger.

By two simple tests you and I can measure the sincerity of the men in Washington and in London who are trying to solve what they call "the dollar crisis."

**One test applies to the British: Is Britain making an honest effort to re-establish itself as a real competitor in world markets?**

**The other test applies to us in the United States: Are we willing to see Britain re-emerge as a strong competitor in world markets—even in our own home market—and to help her do so?**

**Today, even though both countries have faced the devaluation test, the answer to these questions probably is no.**

## I

The situation we face is, in fact, unprecedented. In every important industrial country of the non-Communist world, except Germany and Japan, production is above prewar volume, thanks largely to the Marshall Plan. Yet trade between nations is shackled as it has never been since the 18th century. And the shackles grow day by day. What is worse, two distinct trading areas—the dollar area and the sterling area—have grown up in the non-Communist world, and the gulf between them grows wider.

What kind of leadership have the United States and Britain had in the face of this crisis? President Truman late in August wisely checked the trans-Atlantic bickering over the dollar crisis. *But Mr. Truman showed no awareness of the basic question that the American people must soon decide: Is the United States able and willing to generate trade between nations, as Britain did in the 19th century?*

What have British leaders offered us? Foreign Secretary Bevin and Chancellor Cripps called their September visit to Washington "one of the most important missions in history." *But they did not tell the British people, and perhaps do not admit themselves, that their Labor government must change its internal and external policies if Britain is ever to earn its living in a competitive world.*

Admittedly, the problem Britain has faced since 1945 is a colossal one. But, in the face of its grave difficulties, what has Britain done? The working day was shortened. Welfare economics have run riot. High taxes have sapped incentives. Labor and capital have clung to their prewar psychology of cartels and featherbedding. Government controls and government trading have hamstrung private initiative. Nationalization schemes have injected politics into the struggle for industrial recovery.

Thus the policies of the Labor government have made Britain's adjustment to its new position in the world immensely more difficult. But Americans who attribute the danger of an international breakdown to British socialism greatly oversimplify the problem. Virtually every country in the world, socialist or not, faces the same dollar crisis that Britain faces.

*continued on next page*

We Americans must recognize that our economic strength unbalances world trade as does Britain's weakness. World War II increased America's superior power to produce goods. It also made the United States more self-sufficient. Thus, while the world demand for American goods has risen, our demand for foreign goods, except for basic raw materials, has not increased. Today we sell more to every major area of the world than we buy from it—and yet we wonder why there is a dollar crisis.

**It is time for us to recognize that there are two fundamentally conflicting pressures at work in the United States. One is our desire for a big surplus of exports over imports. The other is our desire for a system of free-wheeling trade around the world. We can not have both unless we as taxpayers wish to subsidize our exports. Which do we want?**

Curtis E. Calder, chairman of the International Relations Committee of the National Association of Manufacturers, says, "The battle of the foreign trade gap is essentially that of reconciling our urge to export our surpluses with a reluctance to accept imports in payment for them . . . The dilemma is an uncomfortable one to face."

## II

**Here, then, are the basic questions that confront men in Washington and London. Does Britain really want expanding world trade or a high-cost welfare state? Does the United States really want expanding world trade or a huge surplus of exports? So far politicians in Washington and especially in London have ducked these issues because they are political dynamite.**

If the people of Britain decide they want to regain their position as a competitive trader in expanding world markets, here are specific objectives that men in London should set for themselves:

*1. Lower government costs.* The British Treasury has asked for cuts of 5% in 1950. But a cut nearer 15% will be necessary, even if that means fewer government subsidies and health services. Enterprise will never revive nor costs come down while taxes take 40% of the British national income, including roughly 60% of business profits.

*2. Fewer government controls.* Only by removing controls and allocations (except on a few necessities) can Britain begin to return to prices fixed by competition rather than by government fiat.

*3. Stronger anti-monopoly legislation for both business and labor.* Britain needs a concerted drive against all forms of restrictive, high-cost practices. This drive should put teeth in the anti-monopoly act and supplement it with legislation to end restrictions imposed by trade unions.

*4. Less restrictive trading practices.* Britain should retreat gradually from its international barter between governments if competition is ever to have free play in international trade.

Meanwhile, if we of the United States sincerely want multilateral world trade, men in Washington must face up to four problems and hammer out workable solutions:

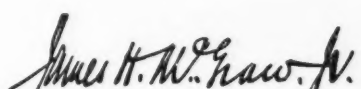
*1. Use of the International Monetary Fund to back a devalued pound.* In time the Fund, in which we have the controlling voice, might be used to promote convertibility of pounds into dollars.

*2. Help for Britain in meeting war-created external debts.* This might mean support for London in getting a reduction of the war debts Britain owes India, Pakistan and Egypt, for example. To achieve such a debt reduction for Britain we might have to underwrite a part of a Southeast Asia recovery program.

*3. Encouragement of American investments abroad.* Such investments should be directed primarily into enterprises which will earn dollars, such as the development of new sources of raw materials, or which will raise productivity abroad.

*4. Our own tariff barriers.* Our attitude toward this critical issue will be the acid test of how deeply we believe in the merits of free world competition.

**If we really want free, competitive trading between the people of the world, these issues must be met and resolved by leaders on both sides of the Atlantic. If we do not want to face these issues, then let us resign ourselves to a world walled off into three trading areas: the Communist bloc, the sterling area, and the dollar area. So far, Washington and London have muddled along, except in facing the devaluation problem. Clarity and courage are still needed.**



*President, McGraw-Hill Publishing Company, Inc.*

# Testimonial for free enterprise

WE started in a blacksmith shop 90 years ago. One of our first jobs in supplying wire was for a fellow named Morse who invented the telegraph. Mr. Morse became one of our very good customers. He also brought us one of our first problems in cable manufacture, and that was finding a good insulating material that would withstand heat and cold, light, wind, weather, water, etc.

Mr. A. G. Day solved the problem with an invention called Kerite—an ingredient which is responsible for the remarkable performance of Kerite insulation. Some early Kerite cable—made nearly 70 years ago—is still in first-class condition.

Kerite made to the old formula is still used in our insulation. That is what makes Kerite insulation such a good buy today—it gives long service at a low cost per year.

The Kerite Company grew out of a need—and has continued growing because it continues to fill a need. That is the way our Free Enterprise system works.

We think Kerite is a good testimonial to American Free Enterprise. And we will constantly endeavor to merit the continued confidence of the people we have served under that system during the last 90 years. The Kerite Company, 30 Church Street, New York 7, N. Y.

**Kerite Insulation—Your Cable's Best Life Insurance**

DAY'S KERITE

**KERITE CABLE**

# The Electric Range's 40th Anniversary

THIS MONTH the electric range is 40 years old. Its birth year was 1909, when George A. Hughes built and sold the first practical electric cook stove. The real commercial beginning came a year later when he exhibited his product at the annual convention of the National Electric Light Association in St. Louis. For his energy and perseverance in its technical and commercial development, George Hughes is rightly known as the "father of the electric range." But he was not the originator of electric cooking. Almost from the beginning of the industry, inventors and promoters had played around with that idea. Hughes' accomplishment was in taking hold of a wobbly idea and making something of it.

It took him a long time to do that. A man of lesser pertinacity—stubbornness, perhaps—would have given up in the face of the difficulties and discouragements of the range's early years. Dying in 1944, George Hughes himself did not see his devotion to an idea rewarded by its complete acceptance. For we can say that today the electric range has fought its way out of the special class and is now what Hughes worked so long to make it—an ordinary thing in ordinary living.

It was not until 1931, 22 years after 1909, that the number of electric ranges in use in this country reached 1 million. One does not need to be very old in the electrical industry to remember how much hard work went into the selling of that first million. But little of that hard work went into selling electric cooking to the American people. Most of it was in selling electric cooking to the men who should have been selling it to the public.

The electric range was slow in comparison with fire cooking. The cost of operating it was high. For too many years these objections prevented popular acceptance of the range. They were real objections for a long time. And, although the substance of fact was removed from them quite a while back, their shadows, their ghosts, remained.

These objections, in substance and in shadow, are now entirely dissipated. It is safe to say this because if it were not true there would not have been sold in the one year of 1948 more ranges than were sold in the first 25 years of the 40 since 1909. Yes, the objections to electric cooking are now gone into the limbo of forgotten things. But it took them an unconscionably long time to go. And the reason they hung around so long does not reflect credit on the electric utilities. They had to accept the range before the public could be expected to. That is why, after 40 years, only one in six American homes has an electric range. This is an anniversary to be observed in a spirit of proper humility.

Alloyed with the humility should be a large proportion of determination—determination that the electric range will not again know the frustration that dogged most of its 40 years and from which it at last is free. There is such danger. It lies in LP gas competition. In the past 10 years the number of electric ranges in use grew from 2.5 million 5.8 million. But the LP ranges increased from 1 million to a claimed 5.5 million in the same period. LP has already prevented the sale of 2 or 3 or more millions of electric ranges. Will it continue so to cut into the market? Not if the electrical industry determines that it won't.

## Electrical Resuscitation

AS IN other fields of science there has been some hope in medicine that a second dose of whatever had had an untoward physiological result might correct the bad effects of the first. That is what the techniques of counter-shock was envisioned as doing for victims of electric shock, drowning, or asphyxiation. It has long been known that many victims have been revived because the heart either did not go into ventricular fibrillation or was restored to functional rhythm by some dimly understood episode of the accident or resuscitation work.

But while such drastic resorts as a blow on the point of the chin or the pit of the stomach might deserve the designation counter-shock, the technique now most promising is much more aptly deserving of the term electrical resuscitation. That is a preferable terminology because the latter technique in no sense is likely to involve the application of a shock of more volts or longer duration than that which caused the erratic heart action. On the contrary, much less voltage and duration may succeed.

The reason for such hopefulness rests mostly in what surgeons are doing with fair success in restoring heart action cases that "died" in the operating room. So far this has meant a quick chest incision and application of massage to the heart until electrodes could be applied. Now the Russians claim that their doctors have had good results applying electrodes externally to chest and back.

In brief, the use of electrical methods of restoration in fields unrelated to that of the electrical worker ought to reassure the accident prevention fraternity and its purse-string bosses that there is something here worthy of thorough exploration. The fruits of confirmation and perfection of the technique might save the lives of 70 or 80 of the linemen who die every year because ventricular fibrillation is so perplexingly unconquerable. Certainly that prospect ought to reassure any skeptics about the legality of applying a procedure increasingly successful in non-electrical casualties in the hospital, nursery, or operating room or the value of this research.

## "Selling Effort Will Be Rewarded"

CASUALLY USED in an informal talk to a press group on the fall sales plans of an appliance manufacturer, the words quoted above deserve to stand alone. They were spoken by R. M. Oliver, manager of portable appliance sales for Landers, Frary & Clark. But they have a much wider application than just to the potential profits of distributors and dealers handling the Universal line. They assert a proven fact that for nearly a decade has largely been forgotten by American business.

In the September issue of *Fortune*, the lead article asks, "What's the Matter with American Salesmanship?" Those who want to know the magazine's reply to the question are referred to the article. It's conclusions are too important, too cogent, to be presented adequately in a short editorial. But we can say here that the article indicates the general business community has lost sight of the fact that selling effort will be rewarded.

Now, as never before in its history, this country needs the rewards of selling effort. It has double need for them. It needs them to strengthen and to re-invigorate our own economy, which has faltered in the past year and is not yet walking forward on wholly firm ground. Sure that capitalism has had its day and waiting for its—to them—imminent crash are many already powerful, and still power-hungry, men, who are ready to spring upon our system and destroy it totally when they judge it to be sufficiently weakened. This situation has doubled the stakes in the game, has doubled the need for selling effort.

Selling effort has been rewarded in this country in superlative abundance. Pulling in harness with production genius, it has put this nation on a higher level of living for all its people than any other nation has ever known. Yet in recent years we have forgotten this. It is vain to explore the reasons for our forgetting. It is more important, in fact it is imperative, if our way of life is to survive, that we remember that selling effort will be rewarded again, as always it has been in our past. Let us go to work, selling ourselves the things we want, selling the world a happier way of life. The reward is sure.

## Shale Oil and Gas Turbine

ABOUT SEVEN TIMES as much oil as this country has used in the 90 years since the first well was drilled in Pennsylvania, 22 times the present national proven reserves of petroleum—In these terms the Associated Press tells of the potentialities of shale oil in a story on the development work of the U. S. Bureau of Mines in Colorado. Moreover, according to the AP report, oil can be extracted from shale for around $2.50 per bbl, about the same as the present price of natural crude at the source.

This promise, in view of John L. Lewis's apparent determination to put coal up in the price class beside that other form of carbon—you know, when the girl says "Yes" and the boy signs his first installment contract—should make the forward-looking utility head begin thinking seriously about the gas turbine. If he is really forward-looking, he can see two parallel avenues of progress opening out ahead. Just in the nature of things, it is to be expected that if shale oil can be produced at competitive cost in what can hardly be more than a prototype process, the future will see that cost reduced. And certainly no one can say that the gas turbine has already reached perfection. Thus, combining the two possibilities we have the very nice prospect of progress by geometrical progression, each forward step in the one path multiplied by the contemporary stride in the parallel road. Something to think about?

# The Electrical Week

Federal power expansion was given a severe jolt this past week in two widely separated areas. In the Northwest, Idaho Power won its suit, at least temporarily, to build a transmission line across federal lands. In the Southeast, a federal judge ruled that the government must pay to Georgia Power development, not actual value for the latter's lands at the Clark Hill project . . . Commonwealth & Southern Corp. just dissolved, claims a lengthy list of achievements . . . And in Washington a Senate subcommittee said "No" to Leland Olds' attempt to get back on the FPC.

*Reynolds Metals' decision to reopen its Jones Mill plant is in line with other aluminum industry moves. Alcoa and Kaiser are stepping up production 25% or more above the July rate. Reynolds says it has filled 74% of the contract demand of Wisconsin Electric Co-op —it's shipped WEC more than 10.5 million lb of conductor in about six months.*

Atomic Energy Commission won't need more money this year just because Russia has the bomb. That's what AEC told the Senate Appropriations Committee. U. S. bomb production is satisfactory, the agency reported, and work on non-military type reactors is going as rapidly as technical knowledge will permit.

*Latest Federal Power Commission figures (as of Sept 1) on coal stocks held by electric utilities show a total of 29,451,185 tons on hand. That's a supply sufficient for 130 days, at the August rate of consumption.*

John L. Lewis' "war of nerves" with coal operators indicates no quick end to the coal strike. The steel strike is conserving steel's coal piles, which might have felt some pinch if the mills had continued operating.

*Frank R. Benedict, Westinghouse Electric Corp, has predicted that energy from the sun's rays rather than atomic power eventually may provide all the world's energy requirements.*

The larger turbine manufacturers report that orders for new units are coming in faster and that negotiations for them have increased rapidly. This bears out ELECTRICAL WORLD's contention that utilities will continue their construction programs into 1955.

*Most unusual was the petition of a small Ohio telephone company to the Utilities Commission for a rate increase. The 42-year-old company asked to raise its rates so that its annual loss would only be $1.10 a year. The PUC was hesitant. It thought that the company ought to make some profit.*

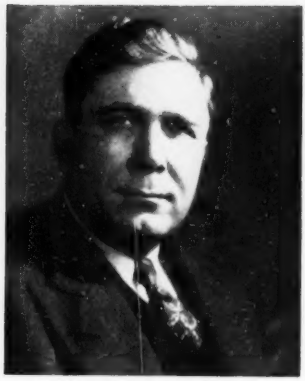
Brownout days are here again, in Canada. Ontario Hydro has ordered restrictions similar to those in effect last winter. Effective date was Oct 1. The reason: Not enough rain, not enough steam capacity, not enough power.

*A report made to the American Psychological Association shows that when one tries to remember something the brain generates electricity. Any day now we can expect a report from Russia that a brain-power station is in operation.*

## Notes From The News

An oil leak caused the explosion that killed two workmen at Southeastern Indiana Power Co's Rushville plant, Jesse M. Wilcox, State Labor Department chief boiler inspector, reported after an investigation . . . Tax evaluations on Indiana's nine largest public utilities have been boosted by more than $25 million. Biggest jump was for Indianapolis Power & Light Co —from $43,205,130 to $47,500,000 . . . Lightning struck the antenna atop the Empire State Building 24 times this summer, according to General Electric Co engineers conducting tests there . . . Alabama Power Co's 1949 kilowatt-hour tax was $522,284, $44,501 above last year's . . . A petition to stop Boston Edison Co from erecting overhead high-tension power lines through Sudbury, Lincoln, and Wayland, Mass., has been denied by Justice Raymond S. Wilkins. The towns had asked that the lines be placed underground . . . Construction of a $13,870,000 hydroelectric project on the Sultan River in northwestern Washington would be unjustified, a Seattle consulting firm has advised the Snohomish County PUD, Everett. The engineers found the proposed construction unnecessary since the PUD has a long-term firm contract with BPA at low rates . . . New Brunswick Electric Power Commission, which already had started preliminary work on a $2.2-million plant, may shift the site to Minto, N. B., because of soft coal mines in the Minto area.

**THOMAS W. MARTIN**
*When he was first C&S president*



**WENDELL L. WILLKIE**
*President when dissolution started*

**JUSTIN R. WHITING**
*Ran a progressive system till the end*

# Commonwealth & Southern Dissolved

## Holding Company Once Had 165 Subsidiaries but Started Simplification before Forced by Law; Record Shows Progressiveness of Operating System

THIS IS an obituary. The deceased, the Commonwealth & Southern Corp, died Oct 1 from the effects of the Public Holding Company Act of 1935. Its survivors include the Southern Co, a holding company controlling four operating companies in the Southeast; Consumers Power Co of Jackson, Mich.; Ohio Edison Co, Akron; and Central Illinois Light Co, Peoria. Two service companies, Commonwealth Services, Inc, and Southern Services, Inc, also survive.

In this brief paragraph is a story of what has happened, but no obituary is complete without a biography, brief though it may be, of the deceased.

Commonwealth & Southern was more than a holding company. This was Wendell Willkie's company, the company whose child, Tennessee Electric Power Co, was torn from it by the Tennessee Valley Authority.

Commonwealth & Southern was organized May 23, 1929. It consisted of 165 separate companies. More than 100 had been eliminated by 1934, when the basic structure consisted of Commonwealth and its 11 direct operating subsidiaries.

This was in line with the "6-point ideal" program laid down when the holding company was formed. This program embraced these points:

1. Reduction of operating expenses and financing costs by bringing electric, gas, and kindred operation in each state under one company so far as practical. Such company to have only three classes of securities outstanding—bonds in open mortgage form and with specific limitations; preferred stock with all shares of equal rank in case of liquidation but issuable in series at different dividend rates to meet market conditions; common stock, all of one class.

2. Elimination of intermediate or sub-holding companies and other non-operating or non-functioning companies.

3. Establishment of a mutually owned service company, with services rendered at cost.

4. Liberal policy of investment by Commonwealth & Southern in common stocks of operating companies to assist each company to finance itself completely and to improve working capital.

5. Elimination of so-called generating and transmission companies, which were selling their entire output to affiliated operating companies.

6. Separating, so far as possible, operations showing losses into separate companies in order to relieve electric and gas operations of these burdens.

This program was well under way when the first attack was made on holding companies under the Public Utility Holding Company Act. The act was introduced in February, 1935, largely as a result of a report of the Federal Trade Commission in January of that year. The report alleged "evil conditions and practices" classified under 19 general heads.

Commonwealth & Southern was quick to answer and deny in its own behalf each and all of the 19 charges, submitting detailed statements that none of the practices, as alleged in general, applied to any practice of its own. It invited and welcomed regulation and the prohibition of abuses but protested abolition of its business life. But, like all other holding companies, Commonwealth & Southern lost.

Bit by bit, one operating company after another was taken away. But as the company dissolved it could point to these achievements:

1. Gross revenues grew from $147 million in 1930 to $279 million in 1948. The price of electricity to the average home customer was reduced 58% over this period. Yearly electric use by the average residential consumer rose 272%.

2. Despite the loss of properties, customers increased from 1,053,729 to 1,872,121.

3. Capacity of generating plants increased 2,947,000 kw since 1930. (Today's total is nearly 5 million kw.)

4. It made no "upstream loans," the borrowing of money from its subsidiaries. Instead, in the early '30's when the subsidiary companies could get money nowhere else, C&S made loans to them and purchased their securities.

5. C&S invested over $96 million in the common stocks of its operating subsidiaries between 1929 and 1934 and another $85 million between 1934 and 1948.

6. All supervisory, financing, engi-

neering, and other services were rendered at cost by the service company, Commonwealth & Southern of New York, which the operating subsidiaries themselves owned.

These achievements can be attributed to the firm policy of C&S which all three of its presidents have supported. Thomas W. Martin, now president of Alabama Power Co, was first president of C&S. He served until 1932 when Wendell L. Willkie took over. In 1940 Justin R. Whiting became president. He was also president of Consumers Power Co, a position which he has retained.

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## 2 Service Companies to Replace One Dissolved

The dissolution of Commonwealth & Southern Corp has led to the formation of two service companies. Both have received approval of the Securities and Exchange Commission.

The one, Southern Services, Inc, will be owned by the electric companies constituting the Southern Co system. This company will take over the work formerly performed by C&S.

Heading Southern Services is H. J. Scholz, a former vice-president of C&S. Other officers are H. M. Tickle, vice-president and comptroller; S. A. Dawley, vice-president and secretary; and R. H. Freese, treasurer.

Exact organization of the second service company has not yet been determined. This company, which will be owned by its employees, plans to establish offices at New York and Jackson, Mich. It will offer its services in both the public utility and industrial fields.

Officers of this company, for which the name Commonwealth Services, Inc, has been proposed, are G. H. Bourne, president; W. B. Tippy, J. H. Foote, and W. J. Herrman, vice-presidents; W. G. Bourne, Jr., vice-president and treasurer; H. S. King, comptroller; and E. E. Nelson, secretary.

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## Buys 3 Small Systems

Purchase of three small electrical systems by the British Columbia Power Commission has been approved by the British Columbia government. They are Lake Cowichan Electric Co, Ltd, for $68,000; the municipally owned distribution system at Ladysmith, $70,000, with a $20,000 rehabilitation program also okayed; and the distribution system of the Kitanmax Water & Power Co at Hazelton.

# Idaho Power Co Wins Initial Effort to Build Line Across Federal Land

IDAHO'S HOTTEST legal "potato"—a power company transmission line crossing federal lands—singed Interior Department hands last week.

On Sept 30 the Department's initial effort to prevent the Idaho Power Co from completing the line was quashed in the U. S. District Court at Boise. Retired Judge Charles C. Cavanah, recalled to the bench to hear the case, refused to grant an injunction against further construction of the line on the public domain. At the same time, he dismissed charges of trespass filed by Interior against the company.

However, as indicated by statements of Interior officials in Washington, the ruling probably will be appealed. In fact, the Department appears inclined to carry the case to the Supreme Court, if necessary, to obtain a reversal.

At stake is a final spelling out of the Department's authority, through the powers vested in its various agencies, to impose restrictions on the use of the public domain by private interests. In this instance, Interior is seeking to stake out a definite claim on power facilities projected by Idaho Power. Other Western utilities with existing or proposed facilities on public lands are watching the legal battle closely.

Meanwhile, Idaho Power plans to resume work on the 185-mile, $3-million line from its Bliss hydroelectric plant to substations at American Falls and Boise. Construction was stopped early in August, when the federal suit was filed and the District Court issued a temporary restraining order.

Pointing out that neither party to the suit denied that some sort of federal permit was required to build the portion of the line crossing the public domain, Judge Cavanah reduced the issues involved to a dispute over jurisdiction. He then held the Federal Power Commission has "exclusive power and authority" to permit construction of power lines on the public domain. Finding that Idaho Power had obtained "pre-license consent" of FPC for the project, he dismissed Interior's complaint and dissolved the temporary injunction he had granted for the duration of the trial.

Judge Cavanah held that "until the (Federal Power) Commission has finally determined and disposed of" Idaho Power's pending application for authorization of the line as part of the Bliss project, "neither the Secretary of the Interior nor any other agency of the government has power and authority to act."

The company asked FPC to amend its Bliss plant license to include the transmission line last April 20. On May 2 the Commission gave pre-license consent for the project, pending final approval or disapproval. The preliminary consent was granted subject to requirements of other agencies having jurisdiction over the lands involved.

It was on the subject of such further jurisdiction that Interior and the company became involved in the legal tangle. Before turning to FPC, Idaho Power asked Interior's Bureau of Land Management for permission to build the line across public lands.

Interior apparently insisted that any permit for construction on the lands contain a provision granting the federal government the right to use the "surplus capacity" of the transmission line. The Department claimed that land laws gave it authority to demand such a proviso. The company objected, holding that Interior could only demand that no damage be done to the land or that the company be held responsible for possible damage.

After obtaining the pre-license consent from FPC, Idaho power began erecting the line—at a mile-a-day rate, according to Interior spokesmen. Interior, through the Justice Department, then filed suit, charging the company with "flagrant and willful trespass."

### *Blackout Ill Timed*

**Pacific Grove, Calif., councilmen were about to approve a new franchise for Pacific Gas & Electric Co recently—having turned down a suggestion by one of their members that a municipal system be considered—when the lights went out. When service was restored, the council tabled the franchise and reopened discussion on the municipal utility proposal.**

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## Signs Contract with BPA

Springfield, Ore., has signed a 20-year power contract with Bonneville Power Administration.

# U. S. Court Rules Government Must Pay Clark Hill's Development Value

IF THE FEDERAL government preempts a hydroelectric site, owned for prospective development by private sources, the government must pay the owners the hydro development value for the property.

Such a ruling last week (Oct 1) by a Federal District Court judge settled a long-standing feud between the Army Engineers and the Georgie Power Co. It also added heavy, and apparently, unforeseen costs to price tags on projects being built on the Savannah River by the Engineers.

Even more important, the decision, if upheld in likely appeals to higher courts, may give pause to future federal grabs at power-company-owned hydro sites. By adding to development costs, the higher value placed on such sites would upset the economic feasibility of federal construction of otherwise marginal projects.

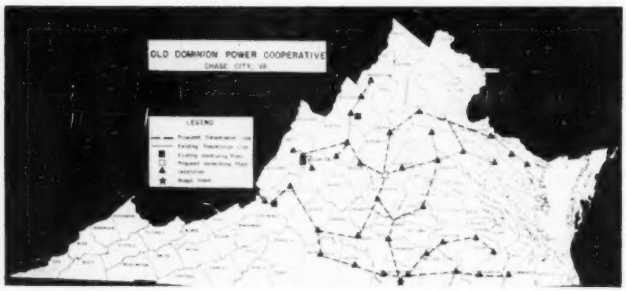
The ruling of Judge C. C. Wyche in the District Court at Spartanburg, S. C., resulted from condemnation proceedings brought by the Engineers to obtain land for the Clark Hill Reservoir. The land involved was purchased over a period of years by the Savannah River Electric Power Co. a subsidiary of Georgia Power. Savannah River Electric planned to develop the Clark Hill site until it was authorized for federal construction.

Judge Wyche's ruling covered the condemnation by the Engineers of more than 5,000 acres of land in South Carolina—included in the Clark Hill project area. Two other District Court judges, who sat with Judge Wyche during joint hearings, have reached similar conclusions in regard to the remaining lands—about 35,000 acres—being condemned in Georgia. Their opinions were expected to follow Judge Wyche's closely covering many of the major issues.

The Engineers previously had proposed to pay for the project lands in small tracts, basing the price for each on the use to which it was being put—farming, etc. Savannah River Electric objected that it had gained title to the land for hydro development purposes and should be paid on that basis.

Judge Wyche upheld this contention, putting an unestimated but obviously higher value on the lands.

"If it is the purpose of the law, and the Supreme Court says that it is, or the policy of the government, to encourage rather than prohibit the water power development of this nation, the accumulation of suitable lands by private companies . . . for purposes of such development, must not be penalized by a denial of any compensation for the value arising from its careful accumulation and integration at great expense of the lands necessary to a profitable water power development, simply because thereafter the federal government itself decides to develop such property . . ." Judge Wyche asserted.




**TERRITORY** to be served by the Old Dominion Power Cooperative of Chase City, Va. The co-op has been granted the largest REA loan in history, $14,320,000, to build a power plant

## Co-op Loan Now Factor in Roanoke Rapids Fight

REA's record-breaking loan to a new Virginia power cooperative was formally entered into the Federal Power Commission's deliberations on the controversial Roanoke Rapids site Oct 3, when final reply briefs were filed by power companies, Department of the Interior, and the Virginia co-ops.

A background statement which REA released to the press in Washington Sept 22 was included with the brief submitted by the co-ops. The statement described REA's approval of a $14,320,000 loan to the Old Dominion Power Cooperative of Chase City, Va. (EW, Oct 1, p 13). The loan the brief termed "an important development" in the Roanoke Rapids case. Final approval of the REA grant has not yet come from the Virginia Corporation Commission.

The Virginia co-ops forming Old Dominion are opposing the application of the Virginia Electric & Power Co for an FPC license to build a hydro plant at Roanoke Rapids, which is also being fought by the Department of Interior.

The brief filed by FPC staff counsel urged that Vepco be granted the license, contending not only that Interior's objections were not valid but also that Interior Secretary Krug "lacks any real basis in existing law to support a claim that he should be given the status of a formal intervenor as a matter of right."

In other briefs:

Vepco replied to Interior and co-op proposed findings and conclusions as "all unnecessary or erroneous" and urged that the license be granted.

Appalachian Electric Power Co. supporting Vepco's application, declared that "private enterprise should be permitted to get on with the job."

Interior, urging federal development of the site, reasserted its contentions that the Vepco plan is not feasible and that approval by Congress and FPC of an Army Engineers report on the Roanoke precluded private development.

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## City, PUD Agree on Split of Puget Sound Property

The City of Ellensburg, Wash., and the Kittitas County PUD, also of Ellensburg, have agreed on a division of Puget Sound Power & Light Co properties in the county in the event of their purchase by a group of PUD's.

The Kittitas PUD is included in the PUD group which proposes to take over all Puget Power properties in the state. Value of the Kittitas County properties, including the Kittitas PUD's share of a pool purchase of some generating properties, has been estimated at about $1.8 million. Division of this amount between the City and the PUD will be determined by an engineering survey.

The City will take over distribution facilities within the city and immediately adjacent to it, while the PUD will take over facilities elsewhere in the county.

# Wide Range of Subjects Discussed at Annual AEIC Business Meeting

THE ASSOCIATION of Edison Illuminating Companies held its annual business meeting at White Sulphur Springs, W. Va., last week. Although AEIC is now celebrating its 65th year, the meeting demonstrated that such age was a measure of maturity, not a year of retirement.

Opening the meeting with a review of industry progress and problems, Pres J. W. McAfee stated that the use of the term "public versus private power" was a misnomer since we actually have public ownership of everything. The problem facing the American people, he said, involves the decision as to whether we shall have voluntary or involuntary investment of funds.

### Technical Activity Growing

A summary of the technical committee report indicated accelerated activity in this field. Further standardization of equipment and methods to bring savings to the industry was emphasized.

Substantial importance is attached to the current problems of air pollution. Although the industry is making rapid progress with its program of installing control equipment for fly ash and cinders, it was strongly recommended that continued studies be made to assure further progress in this field. A committee will be formed to make recommendations for action by the Association.

### Radiation Control Important

The control of incidental radiation devices involving carrier communication and relaying systems was pointed out as the next important problem affecting the utilities in the field of FCC regulation. The Joint Coordinating Committees of the Association and of EEI-NEMA-RMA on Radio Reception is considering this problem.

The technical committee reports were presented by G. M. Armbrust, Power Distribution; G. B. M. Robertson, Metering and Service Methods; H. K. Sels, Electric Switching and Switchgear; and P. W. Thompson, Power Generation.

Dr Virgil Jordan, chancellor, National Industrial Conference Board, Inc, addressing the group, expressed the belief that "this country will be carried by 1952 from the 'Santa Claus State', or 'Handout State'—directly into the paradise of outright socialism, which the British people and most of the rest of Europe have so much enjoyed while we could pay the bills."

Constantine Bary, chairman of the Load Research Committee, reported that the electric clothes drier would be a desirable load-building appliance for most companies and urged that each company study the incidence of use of various appliances. He also stated that there is evidence that popular interest is developing in the field of electric house heating and suggested that serious attention should be given to its impact on electrical systems.

A report upon the Sales Executives' Conference of September, 1949, was made by L. W. Heath, vice-president, Pennsylvania Power & Light Co. Robert E. Ginna, vice-president, Rochester Gas & Electric Corp, reported on a survey of utilities showing that in 1950 71% would be in merchandising activity, compared with 79% in 1940 and 65% in 1949. Carl T. Bremicker, Northern States Power Co, reporting upon recent rate changes, found by survey that there was little adverse reaction among customers to the small increases made.

W. E. Parrott, manager of Sales Department, Ebasco Services, Inc, painted a bright picture of the future and stated, "The 1950 possibilities and opportunities for increased use of electric service in the commercial and industrial fields is almost unlimited."

Maj Gen Leif J. Sverdrup, USA, ORC, advised that the industry must not rest upon its record of the last World War. The people must be fully confident of the adequacy of power for future emergencies.

These officers were elected for the coming year: J. W. McAfee, president; P. H. McCance, vice-president; Frank V. Magalhaes, secretary-treasurer; and Executive Committeemen: Walter C. Beckjord, A. M. Beebee, George H. Blake, Prentiss M. Brown, Ralph D. Cutler, E. J. Doyle, S. Ferguson, E. L. Lindseth, H. P. Liversidge, A. G. Neal, James W. Parker, W. H. Sammis, H. M. Sawyer, R. H. Tapscott, G. W. Van Derzee, and Justin R. Whiting.

William Schmidt, Jr, withdrew as vice-president because of lack of time for additional Association activities.

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## Co-op May Use Streets

Voters of Cassville, Mo., have granted the Barry Electric Cooperative a 10-year contract to use the city streets and alleys for lines and for a white way to be erected on Main Street.

## Research in Electric Resuscitation Advocated

Recent success in hospitals in applying electric resuscitation in blue-baby and succumbing operation cases prompts Dr. W. B. Kouwenhoven of Johns-Hopkins University to believe that research would show similiar techniques capable of stopping ventricular fibrillation.

On the strength of his description of the potentialities, the Edison Electric Institute's Accident Prevention Committee Sept 22 in Newark reaffirmed its advocacy of a research subsidy to ascertain whether external electric impulses will reestablish heart rhythm without insertion of electrodes within the chest. Russian scientists have reported successful resuscitation through external (chest to back) application of a 500-1,000-v discharge from a 20-30 micromicrofarad condenser.

### Stresses Job Training

D. C. Luce, vice-president of electric operations of Public Service Electric & Gas, expressed the hope the committee would sustain its stress on job training and other measures designed to achieve the accident-free operation which is the goal of all utilities.

The year 1948 proved better than 1947, but nevertheless was the second worst year in electric utility accident rate since 1941, according to D. C. Stewart, Buffalo Niagara Electric Corp, who added that the type distribution is surprisingly constant. Last year electric burns and shock fatalities again constituted 68%, falls 14%, and motor vehicles 8%. One death in 5 would be averted if linemen would only wear the gloves prescribed.

### Favors Longer Use of Rubber

Considerable support was manifested for the New England Power 100% ground-to-ground requirement of rubber gloves reported by F. G. Harriman. Rather, however, than this invariable prescription of rubber gloves as soon as the man climbs the pole, C. A. Fischback of Southern California Edison favored covering of circuits ostensibly deenergized.

There was some desire for a low-voltage glove for 0-600-v work despite fear by some it would inadvertently be used on higher voltage. Several companies use or plan to use pole guards.

One company reported a high percentage of failures of new rubber equipment in field and test due to inclusions, but there was practically no confirmation except from another company reporting rejections after 60-90 days of use because of inside cracks.

**DIRECTORS** of the Indiana Electric Association in session at French Lick are, left to right, W. H. Baker, Rockport Water Works Co; C. K. Graham, Southern Indiana Gas & Electric Co; E. D. Anderson, Northern Indiana Public Service Co; R. A. Gallagher, Public Service Co of Indiana; E. F. Hauser, IEA; G. J. Oglebay, Public Service Co of Indiana; H. T. Pritchard, Indianapolis Power & Light Co; D. H. Mitchell, Northern Indiana Public Service Co; P. W. Ross, Indianapolis Power & Light Co; Arnold Hagan, Indiana & Michigan Electric Co

# Indiana Group Told Salesmen Are Needed, Standby Atom Power Soon

THE FUTURE and not the past was "eyed" last week by the 400 delegates at the annual convention of the Indiana Electric Association at French Lick.

J. M. Stedman, general commercial manager, Pennsylvania Power & Light Co, saw trouble in the future. "Missing men, the 2,200,000 creative salesmen that American industry is short today, can signify trouble, calamity, dire results," he said.

Some 300,000 of these salesmen, he continued, are missing from our own and allied industries, and appliance retailing alone is short 140,000 salesmen, 45,000 in utility sales staffs. Stedman based his figures on the prewar ratio of 1 to 14 in sales work in comparison with today's ratio of 1 to 29.

In another field R. J. Kryter, treasurer and sales manager, Esterline-Angus Co, saw a brighter future: "Useful electrical energy will be developed from atomic sources during the present generation but only to supplement customary sources." Atomic power will be most useful where other sources of energy are not available, where very high energy concentrations are needed, or where extremely large amounts of energy in the form only of heat are needed.

Atomic power will not be dominant until and unless it can be obtained from cheap and abundant materials or until it can be obtained directly as electricity. In analyzing possibilities of atomic energy for electric power, Kryter estimated that its cost would be from 4 to 10 mills per kwhr delivered to the switchboard. Fuel cost would be negligible, investment cost high, and maintenance terrific.

The threat of a future under government ownership was dealt with by J. B. Thomas, president of the Texas Electric Service Co and an active leader of the Public Information Program. He used statistics and maps to show the imminence of the great deadening paralysis, the "galloping paralysis" of socialism.

In support of his contention, Thomas stressed that, according to government statistics, rural electrification is 71% completed. But the Rural Electrification Administration has a billion dollars available, more than has already been spent to get 71% of the job done. Most of this billion, he claimed, is for duplicating transmission lines and for building relatively inefficient generating stations. The result of these non-tax-paying enterprises will be a greater burden on taxpayers.

E. D. Anderson, vice-president, Northern Indiana Public Service Co, was elected association president. C. V. Sorenson, vice-president, Indiana & Michigan Electric Co, was elected vice-president. E. F. Hauser was retained as secretary-treasurer.

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## Utility Buys Plant Site

Ohio Power Co has purchased 108 acres near McConnelsville as the site of a proposed 300,000-kw, $30-million generating plant. Construction is not expected to begin for several years until demand for power grows.

## Engineers, Reclamation Clash on Water Project

A bitter "jurisdictional dispute" has flared up between the Army Engineers and the Bureau of Reclamation over who is to water the rice fields of southeastern Arkansas.

Authorization for the Grand Prairie Region and Bayou Meto Basin Water Project is in the omnibus Rivers and Harbors Bill now in the Senate Committee on Public Works. Flood control for Bayou Meto and increased water supply for Grand Prairie's rice fields have been provided in recommendations of the Engineers. Included are provisions for the cooperation of the Department of Agriculture in the farm phases of the program.

Because Interior's Bureau of Reclamation is limited by law to 17 Western states, not including Arkansas, the Engineers would appear to be the only agency available for carrying on the project. But Interior officials, who lost no love on the 17-state provision, are hopping mad.

Declares Interior Secretary Krug, "It constitutes a threat to the integrity of the long-established federal reclamation policy and places three agencies instead of one as responsible for the development of federal irrigation projects in the United States."

Another Interior spokesman calls the proposed irrigation activities of the Engineers "the camel's nose under the tent."

The Engineers would like to label the whole thing "water supply," but they admit that portions of the project might be called "irrigation." Interior maintains that it can claim jurisdiction through Section 8 of the Flood Control Act of 1944, putting reclamation use of water under the Secretary of Interior.

Whether Congress finally adopts Interior's view of Section 8, or the Corps' 17-state argument will be important to future federal water development outside of Reclamation's bailiwick.

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## Folsom Dam Authorized

A bill authorizing California's American River project and including Folsom Dam in the Central Valley development was approved with Senate amendments by the House Sept 29. The Corps of Engineers is authorized to construct the Folsom Dam and Reservoir, with a storage capacity of 1 million acre ft, at an estimated cost of $51.8 million. The Bureau of Reclamation was authorized to build hydroelectric plants to an estimated total of $59.2 million.

# Bills Affecting Power Industry Still May Beat Congress's Adjournment

WITH CONGRESS heading down the home stretch toward a Nov 1 adjournment goal, a few pending measures of interest to the electric power industry still have fair chances of enactment.

Interior and Army Engineers' appropriations are in House-Senate conference, from which they will soon emerge. Congress this week passed it's fifth stop-gap spending resolution to keep the two federal power agencies and others in business.

The REA phone bill's chances of passage this year are looking up. Senate action was scheduled this week. If a Senate committee's amendments are approved on the floor, the bill will go to conference, with REA supporters scrapping to take out the Senate committee's 1,500-customer limit and other restrictions which were not in the House measure. A conditional appropriation of $25 million for REA phone loans must be approved by the House.

The Rivers and Harbors Bill—omnibus measure authorizing new dams—is in the Senate Public Works Committee, where it is getting prolonged study. Main points of discussion in the Senate committee include:

1. The House-approved Grand Prairie water supply projects in Arkansas, which is slated for development by the Army Engineers.

2. The half-billion-dollar, three-year Columbia River program approved by a Senate subcommittee. Of the huge authorization, $300 million would go to Army Engineers, $200 million to Reclamation. This bill provides for long-range authorizations—not appropriations—and it might be carried over until next year.

Federal power leaders, among others in cabinet and top government agency posts, will get a pay raise. The Senate scaled down some of the House-approved figures, but the pay checks in many key government positions will be jumped.

Minimum wage goes up to 75¢. The bill's in conference, where details of retail trade exemptions are being worked out.

Social Security boost Jan 1 will be an automatic legal provision for increase to 1.5% payroll tax on both employee and employer. Broad new legislation will pass the House, but the Senate won't act until next year.

## Commerce Subcommittee Rejects Olds' Nomination

Leland Olds lost a decisive first round in his fight for a third term on the Federal Power Commission when a Senate subcommittee unanimously voted on Oct 4 to report his nomination unfavorably.

The 7-0 vote against Olds by the subcommittee, headed by Sen Lyndon Johnson, Texas Democrat, also insured an unfavorable report by the full Committee on Interstate and Foreign Commerce, of which the seven subcommittee members form a majority. The early action, after a week of sharp testimony, indicated that foes of the nominee are pressing for a Senate vote, confident they can defeat Olds on the Senate floor.

Rejection of Olds by the full committee might temper President Truman's insistence on the Olds appointment. The President could end the bitter row by withdrawing the nomination at any time.

But this week also produced an opinion that Olds might be given a recess appointment after Congress adjourns, even in the face of an adverse vote by the Senate. This was voiced by Senate Parliamentarian Charles L. Watkins. Under his interpretation, Olds could conceivably serve many months as a commissioner if the Administration chose to defy the Senate.

Several Olds proponents referred during the hearings to opposition to the nomination from power companies, but none of the nearly 40 witnesses, for and against Olds, was identified with any utility company.

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## AEC Asks Bids on Steam Station for Los Alamos

Bids have been asked by the Atomic Energy Commission for the construction of a steam power plant to provide electricity and steam for heating and processing at Los Alamos, N. M. Bids will be opened Nov 15. The plant is to have two 5,000-kw turbo-generators. Plans will allow for a third generator.

The new generating plant will be tied in with the present diesel-electric plant by underground cable. The latter plant will be retained in standby operating condition for emergencies.

## Electric Figures Mixed with Gas in BLS Change

The Bureau of Labor Statistics, in a general revision of its reports on employment, hours, and earnings, has discontinued publishing these statistics for the electric light and power industry as such. Instead, the figures now cover both gas and electric utilities.

For more than a decade the electric power industry has relied on the BLS reports for basic data on its own labor force. Edison Electric Institute, for example, used the BLS figures in its own labor and employment statistics. Individual companies also relied on the government agency.

A spokesman said EEI probably would gather its employment data directly from member companies.

The new BLS figures show July employment as 520,000, average weekly earnings as $64.14, average hourly earnings as $1.55, and average weekly hours as 41.3. August employment rose to 523,000, which was 8,000 above June. On the new basis, the statistics have been revised back to the beginning of 1947. The new employment figure for April, 1949, is 507,000. The old one, limited to employees in electric light and power plants, was 283,000.

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## Jones Mill Aluminum Plant Open, Shut, Open

That on-again, off-again shutdown of the Reynolds Metals Co's Jones Mill, Ark., aluminum plant is off again. In a letter to employees on Oct 4, R. S. Reynolds, president of the firm, announced that the plant would be reopened "immediately."

Just two weeks ago a seven-week strike of employees of the plant ended when the company signed a contract with CIO's United Steelworkers. But shortly thereafter the company, in another letter to the employees, gave notice that the plant would be closed indefinitely. Reasons given for the closing were a slump in the demand for aluminum and large inventories of the metal.

This week's reopening announcement hailed a "sharp pick-up in demand" for the metal.

Company officials assured ELECTRICAL WORLD (which asked while the shutdown was still scheduled) that Reynolds' conductor contracts could be adequately supplied. The company's arrangement with the Wisconsin Electric Cooperative to supply its customers with conductor would not be affected, they said.

# What Qualities Create Stock Appeal? Experts Tell in GPU Questionnaire

FINANCIAL EXPERTS don't like to see a utility issue new common stock in big jumps just for the sake of improving its capitalization ratio.

They find that ratio "unsatisfactory" if more than 54% of capitalization is debt and less than 27% is common stock. "Blue chip," in their eyes, means about 44% bonds, 17% preferred stock, and 39% common and surplus. But an overwhelming majority agrees that dilution of equity by issue of new common increases total capital costs—and many feel that is not in the interest of present stockholders.

### Explain Bases of Ratings

Such, at least, are the opinions of 64 financial analysts and others in a position to mold investor judgments. These experts filled out a questionnaire prepared by A. F. Tegen, president of General Public Utilities Corp, in an effort to find out which items on a utility balance sheet influenced their ratings of its stocks. Tegen was seeking guidance for the electric utility industry in its attempt to finance expansion by raising new equity capital—and he uncovered a number of attitudes that may represent the reasoning of what he calls "the more sophisticated" investors.

Here are some of their recommendations:

### Payout Major Consideration

Payout policy, says Tegen, affects a common stock's market price more than any other single item. Assuming a utility has a substantially cleaned-up balance sheet, reasonably level earnings, and no substantial sinking fund requirements, the analysts demand a payout ratio of at least 78%. Many thought it should be higher.

The experts said level dividends were more important in determining a stock's overall investment position than a relatively full payout of earnings as they accrue, but many of them qualified that answer by adding, "assuming a generous payout." Tegen's conclusion was that stockholders will be critical of a management whose payout is low, especially if it uses the excuse that it wants "to be sure to maintain a level dividend."

About 12% of gross revenue should be available for common dividends. The analysts consider 18 to 20% a high percentage and 10% low. Despite the fact that dividends are paid out of earned surplus, most of the experts said the amount of the surplus had little significance for them.

New common shares will find the market most receptive if they sell at about $21. Since trading ordinarily is in lots of 100 shares, investors find a price above $45 too high. If it's below $10, they regard the stock as speculative.

They like to have pre-emptive rights in a charter and think stock less valuable if rights are limited, as some recent amendments to utility charters provide. Cumulative voting, on the other hand, they consider of no tangible value to the stockholder.

Depreciation is important to investors, who will think less kindly of a stock if the amounts of reserve and annual accrual for this purpose are out of line. In judging the adequacy of these funds, they place great weight on findings or opinions of regulatory commissions.

Book value of a common stock is significant, in the opinion of most of the analysts. However, a strong minority thinks it has no bearing on the stock's market value. Statistically, says Tegen, there seems to be no relationship.

From the common stockholder's point of view, convertible securities are not a satisfactory financing device. Preferred stocks with sinking fund provisions also are unpopular with the investors' advisers, who would prefer serial debentures.

## FINANCIAL BRIEFS

**Changes** in Securities and Exchange Commission regulations and other possible actions to facilitate financing of utility expansion are recommended in a joint study of the problem to be published early next month by American Gas Association in conjunction with Edison Electric Institute. Co-chairmen of the committe that made the 18-month study are Edward H. Morehouse, vice-president, General Public Utilities Corp, and Harold H. Scaff, vice-president, Ebasco Services, Inc. ELECTRICAL WORLD will summarize their findings when the final report becomes available.

**Issuance of additional** utility bonds totaling $200,000 has been voted by Tipton, Ind., City Council to complete construction of the City's new municipal light plant and rehabilitate the distribution system. Cost of the work has run far beyond the original estimate.

**Federal court decision** has been reserved on an SEC application for approval of the proposed dissolution of Niagara Hudson Power Corp. Stockholders have objected to the plan, which calls for consolidation of Niagara Hudson's three main units, New York Power & Light Corp, Central New York Power Corp, and Buffalo Niagara Electric Corp, into a single utility.

**SEC authorization** for repurchase and retirement by Memphis Generating Co of 1,000 of its 39,000 outstanding $100-par common shares held by National Power & Light Co has been requested by the two companies. They propose that Memphis pay the par value and reduce its capital the same amount by retiring the shares. Interested persons have until Oct 12 to request a hearing.

## SEC RULINGS

**Rochester Gas & Electric Corp's** common stock sale to stockholders of General Public Utilities Corp (New York) of record Sept 8, 1949, has received final SEC clearance. Under the terms of the offer, the Rochester stock is to be offered to the GPU stockholders at $28.50 per share, the subscription right being at the rate of one share of Rochester stock for each 10 shares of GPU stock and the subscription period to expire Sept 30. (Release No. 9318).

**New England Gas & Electric Association,** Cambridge, Mass., has received authorization from SEC to offer 124,601 shares of additional common stock for subscription at $11.25 per share by common stockholders on a one-for-ten basis. Proceeds will be used by NEGEA to retire $1,250,000 of short-term bank notes. At the same time, six subsidiaries of NEGEA were authorized to make temporary borrowings for construction purposes from First National Bank of Boston as follows: Cambridge Gas Light Co, $250,000; Dedham & Hyde Park Gas Co, $100,000; Cape & Vineyard Electric Co, $600,000; New Bedford Gas & Edison Light Co, $2,250,000; Plymouth County Electric Co, $825,000; and Worcester Gas Light Co, $1.2 million. The Commission deferred decision on $402,000 of proposed bank borrowings by an additional subsidiary, Cambridge Electric Light Co, pending consideration of company proposal for an additional $510,000 equity investment by NEGEA in Cambridge Electric. (Release No. 9340).

**Union Electric Co of Missouri** has received authorization to make additional common stock investments in its subsidiary, Union Electric Power Co (both of St Louis), to be applied to the latter's construction program. The proposal involves the issuance and sale by the subsidiary to the parent of $6 million additional common stock ($20 par) during the period ending Nov 30, 1949. (Release No. 9348).

## Output Moves Downward Again; +1.3% Change

The electric output curve moved downward again during the week ended Oct 1, 1949, according to figures released by the Edison Electric Institute. The amount of electrical energy distributed by the light and power companies during the week totaled 5,521,238,000 kwhr, comparing with 5,448,554,000 kwhr during the corresponding week last year. The percent change narrowed to +1.3 from +1.7 the preceding week, the narrowest margin since the end of August. During the preceding week, ended on Sept 24, the output amounted to 5,555,641,000 kwhr.

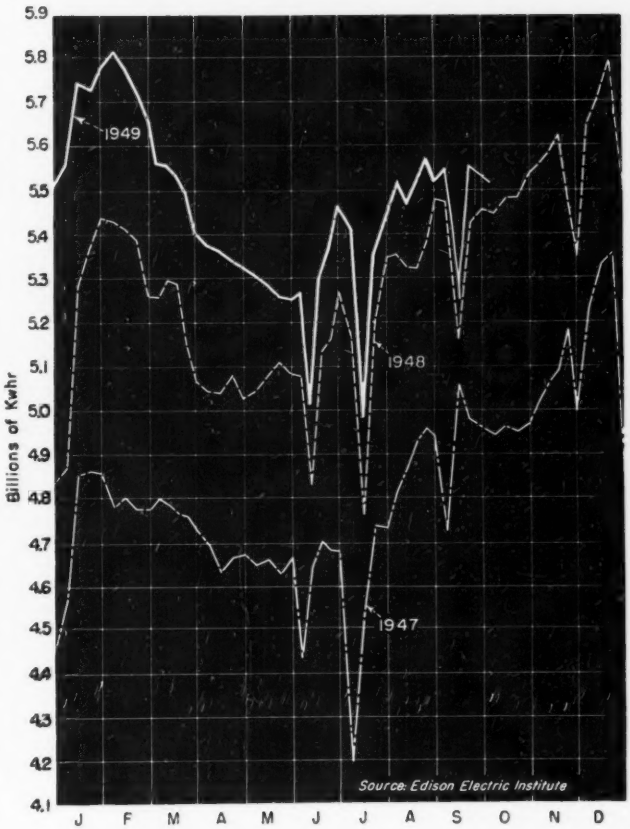
The largest individual increase was shown by the South Central group, with an increase of 8.8%. The Pacific Coast States ran second, 8.1%.

**Weekly Output, Millions Kwhr**

| 1949 | | 1948 | | 1947 | |
|---|---|---|---|---|---|
| Oct 1 | 5,521 | Oct 2 | 5,449 | Oct 4 | 4,935 |
| Sept 24 | 5,556 | Sept 25 | 5,461 | Sept 27 | 4,956 |
| Sept 17 | 5,579 | Sept 18 | 5,426 | Sept 20 | 4,977 |
| Sept 10 | 5,258 | Sept 11 | 5,166 | Sept 13 | 5,053 |
| Sept 3 | 5,544 | Sept 4 | 5,470 | Sept 6 | 4,721 |
| Aug 27 | 5,523 | Aug 28 | 5,478 | Aug 30 | 4,940 |
| Aug 20 | 5,579 | Aug 21 | 5,391 | Aug 23 | 4,953 |
| Aug 13 | 5,530 | Aug 14 | 5,318 | Aug 16 | 4,923 |
| Aug 6 | 5,466 | Aug 7 | 5,319 | Aug 9 | 4,874 |
| July 30 | 5,518 | July 31 | 5,352 | Aug 2 | 4,806 |
| July 23 | 5,462 | July 24 | 5,342 | July 26 | 4,730 |
| July 16 | 5,342 | July 17 | 5,197 | July 19 | 4,732 |

**Percent Change from Previous Year**

| | Oct 1 | Sept 24 | Sept 17 |
|---|---|---|---|
| New England | + 3.4 | + 3.1 | + 3.7 |
| Mid-Atlantic | + 2.3 | + 2.7 | + 1.4 |
| Central Industrial | − 4.6 | − 3.8 | − 1.6 |
| West Central | + 2.7 | + 0.4 | + 2.9 |
| Southeast | + 4.0 | + 5.2 | + 5.1 |
| South Central | + 8.8 | + 5.4 | +11.9 |
| Rocky Mountain | + 6.9 | + 7.2 | + 9.1 |
| Pacific Coast | + 8.1 | +10.8 | + 7.8 |
| Total United States | + 1.3 | + 1.7 | + 2.8 |




# MEETINGS

**Edison Electric Institute**
Prime Movers Committee, Sheraton Hotel, Rochester, N. Y., October 10-11; Transmission and Distribution Committee, Lord Baltimore Hotel, Baltimore, Md., October 31-November 1.

**Iowa Utilities Association**
Management Conference, Hotel Fort Des Moines, Des Moines, Iowa, October 10-11.

**American Society for Testing Materials**
First Pacific Area National Meeting, Fairmont Hotel, San Francisco, Calif., October 10-14.

**American Standards Association**
Annual Meeting, Waldorf-Astoria Hotel, New York, October 11-15.

**International Association of Electrical Leagues**
Annual Conference, Hotel Cleveland, Cleveland, Ohio, October 12-15.

**Electrochemical Society**
Fall Congress, La Salle Hotel, Chicago, Ill., October 12-15.

**American Institute of Electrical Engineers**
Midwest General Meeting, Netherlands Plaza Hotel, Cincinnati, Ohio, October 17-21.

**American Welding Society**
Annual Meeting, Hotel Cleveland, Cleveland, Ohio, October 17-21.

**Pennsylvania Electric Association**
Transmission and Distribution Committee, Fort Ligonier Hotel, Ligonier, Pa., October 20-21; Relay Committee, Americus Hotel, Allentown, Pa., October 13-14; Systems Operation Committee, Split Rock Lodge, Blakeslee, Pa., October 20-21; Electrical Equipment Committee, Hotel Edison, Sunbury, Pa., October 27-28; Communications Committee, Benjamin Franklin Hotel, Philadelphia, Pa., November 3-4.

**Missouri Valley Electric Association**
Accounting Conference, Robidoux Hotel, St Joseph, Mo., October 20-21.

**National Safety Council**
National Safety Congress and Exposition, Stevens, Congress, Morrison, Sherman Hotels and the Palmer House, Chicago, Ill., October 24-28; Electrical Equipment Section, Stevens Hotel, October 26-27.

**National Metal Trades Association**
Annual Convention, Palmer House, Chicago, October 26-28.

**Southeastern Electric Exchange**
Sales Conference, Biltmore Hotel, Atlanta, Ga., October 26-28.

**Institute of Radio Engineers-American Institute of Electric Engineers**
Conference on Electronic Instrumentation in Nucleonics and Medicine, Hotel Commodore, New York, October 31-November 2.

**National Electrical Contractors Association**
Annual Conference, Rice Hotel, Houston, Tex., November 8-11.

**National Electrical Manufacturers Association**
Annual Meeting, Chalfonte-Haddon Hall, Atlantic City, N. J., November 14-18.

**Refrigeration Equipment Manufacturers Association**
All-Industry Refrigeration and Air Conditioning Exposition, Atlantic City Auditorium, Atlantic City, N. J., November 14-18.

**New Jersey Utilities Association**
Annual Meeting, Seaview Country Club, Absecon, N. J., November 18-19.

**Wisconsin Utilities Association**
Joint Annual Convention, Electric and Gas Section, Schroeder Hotel, Milwaukee, November 21-23.

**Exposition of Chemical Industries**
Grand Central Palace, New York, N. Y., November 28-December 3.

**American Society of Refrigerating Engineers**
Annual Meeting, Edgewater Beach Hotel, Chicago, Ill., December 4-7.

**American Society of Agricultural Engineers**
Winter Meeting, Stevens Hotel, Chicago, Ill., December 19-21.

**National Farm Electrification Conference**
Stevens Hotel, Chicago, Ill., December 20-22.

★ **Plant Maintenance Show and Conference**
Auditorium, Cleveland, Ohio, January 16-19.

★ **Southwest Air Conditioning Exposition**
Hall of Agriculture and the Poultry Building, Fair Park, Dallas, Tex., January 23-27.

★ Additions this week

# WASHINGTON COMMENT

WILLIAM B. WHICHARD

IT LOOKS NOW as if Leland Olds won't go to work for National Security Resources Board, after all.

Certain Senators literally frowned out loud at reports that Olds was about to become a consultant for NSRB pending disposition of his reappointment to the Federal Power Commission.

The miffed Senators included several members of the committee in charge of action on his FPC nomination. Their wrath threatened to rip the fragments of Olds' already badly tattered prospects for regaining his seat on FPC.

Fortunately for Olds, he was able to assure the Senators that he had done no work for NSRB. This report immediately eased some of the unhappiness. His consulting for the mobilization planning agency was to have been done on a per diem basis. So, technically at least, he had never gone to work for NSRB.

He probably never will, as things stand now, certainly not while this step would jeopardize further his FPC candidacy—and that will be until the Senate votes on it or adjourns. If the nomination fails to come to a vote before adjournment, Olds is a cinch for an interim appointment to the Commission.

But the NSRB incident remains one of the most intriguing in Olds' long and hectic Washington career. From a bureaucratic viewpoint, it makes a human interest story rivaling anything the soap operas ever attempted. A story replete with drama, suspense, pathos—everything.

It started within the past few weeks, when someone within whispering distance of the White House made a discovery. The discovery was that the Senate was doing nothing fast on the President's nomination of Olds to FPC.

The nominee, never a wealthy man, had been off the federal payroll since June 22, when his second FPC term expired. So long as Congress stayed in session, he could not be given an interim appointment. And it was beginning to look as if Congress might not adjourn before Christmas, if at all.

Though of somewhat vague origins, the do-something-for-Olds movement snowballed—proving, among other things, that big government has a heart under all that red tape. According to the testimony before the Senate committee, Olds talked jobs with Presidential Advisor John Steelman, acting chairman of NSRB, and "others" at the White House. He didn't accept or refuse the consulting work, Olds indicated. But so many other people thought he had accepted it the story was all over Washington within days.

Edward Falck, to whose Office of Energy and Utilities the new consultant was to be assigned, must have viewed all these developments with considerably mingled emotions. A year ago—Oct. 27, 1948, to be exact—FPC formally complained to the then head of NSRB, Arthur M. Hill, of Falck's remarks before the American Gas Association. The complaint pointedly noted Falck's business connections with gas industry clients. The implications were clear—and unpleasant. As Falck must have known, the letter to Hill had the approval, perhaps more, of Leland Olds.

# TECHNICAL NOTES

ARCHER E. KNOWLTON

**Treated lumber** and timber production in 1948 shrank 18%; use of liquid preservatives the same amount, with creosote unchanged but pentachlorophenol going down 78% and copper naphthenate 99.9%.

**Acrylin resin** is reported to be a good non-corrodible lining for electroplating tanks.

**Rubber sleeves** are being accepted as a supplementary means of preventing accidental contact, especially if the men roll up their shirt sleeves in warm weather.

**Coal sticking** in bunkers is often more acute if the depth exceeds 35 ft. Depths in practice, however, extend to 85 ft.

**Stainless-steel-clad** plates gave one company five times the life of ordinary carbon steel when used to combat the corrosion of coal chutes and gates.

**Gunite lining** of steel stacks is preferred to radial brick chimneys whether brick or tile lined.

**Polyethylene** has an extremely low rate of water absorption and is being used as the insulation in low voltage submarine cables.

**Flyash** added in the proportions of 1:5 to cement gives a minimum strength of 3,500 psi after 28 days aging.

**Oil reclosers** in one group of 574 had 6,418 operations, 18 of which were adverse; the same utilities reported 818 open-type repeating fuses with 325 operations, 23 of which were adverse; 99 enclosed type had 47 operations of which 4 were adverse.

**Chlorination** of condensing water at 1 gpm saved one company about $12,000 a year by preventing fouling of intakes handling 9,400 cfm.

**Electrolytic corrosion** is often accelerated when trolley cars are abandoned; in New York 70% of the cable corrosion is caused by other than stray currents.

**DEMONSTRATIONS** of counter cooking equipment in the customer's own establishment have been a major factor in promoting sales. Here West Penn's L. G. Barabas demonstrates griddle-grill to the operator of the Greenock Recreation Centre lunch counter

# For New Revenue — Look to Commercial Cooking

**The company that won the 1948 Hughes Award for commercial electric cooking promotion tells what it has learned in 14 years of activity in this field**

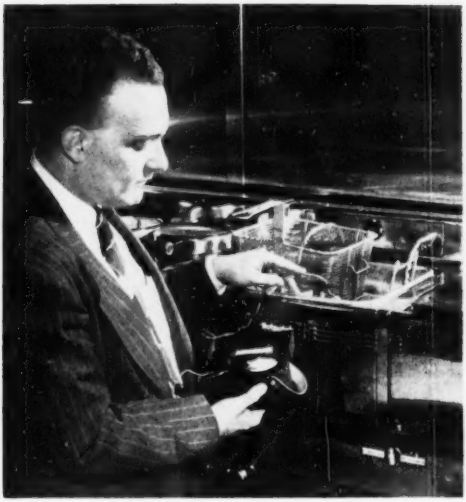
**H. E. KING,** Commercial Sales Supervisor, West Penn Power Co, Pittsburgh, Pa.

FOR West Penn Power Co, the promotion of commercial cooking has proved to be a very profitable undertaking. In three of the past four years it has outstripped the new revenue from general interior lighting. Last year alone 4,438 kw of commercial electric cooking load was added. It brought the company $110,949 of new annual revenue, equivalent to 27.6% of the total new business developed by the commercial sales department.

Compare these results with those of 1934, the last year before we began our promotion. New cooking load reported that year totaled only 49 kw and accounted for 3% of the total new revenue developed by commercial sales. In fifteen years since, cooking has risen from a position of relative obscurity to one of major importance as a source of new commercial revenue.

Today, revenue wise, promotion for cooking is proving to be more profitable than that for lighting. In 1948, cooking load increases averaged 7.6 kw, producing $191 in new revenue. Lighting load additions averaged 2.5 kw, resulting in $84.40 of new revenue per load increase. As further evidence of this fact, based on total contacts in 1948, cooking

**AT EXPOSITION** of Restaurant Association, H. S. Orton, West Penn (left above), and two customers learn about a food warmer



**FORSTALLING CUSTOMER** dissatisfaction has kept load mortality to about 16%. Here R. E. Haden checks a fry kettle thermostat

# West Penn's commercial sales representatives know

averaged 0.726 kw increase per call, or $18.18 in new revenue compared to 0.264 kw or $9.00 in new revenue for lighting per call.

The potential market for commercial electric cooking equipment in West Penn territory is sizeable. Based on a customer survey the potential cooking load totals 119,147 kw. In terms of new revenue this amounts to approximately $2,500,000, or about 45% of our present annual commercial revenue. Thus, while we have sold 20,000 kw of cooking load to date, we have tapped only 15% of our potential market. Within ten years or less we expect to have captured 50% of this profitable market.

Most of the commercial electric cooking equipment installed stays sold and remains in operation over the period of its useful life despite a fairly large turnover in ownership or management of food service establishments. A survey of electric cooking users, now under way, indicates a load mortality of approximately 16% for equipment installed in the years 1940-48. Thus, 84% of the load sold in the past thirteen years is still in operation and producing revenue.

Many of the factors favoring commercial electric cooking promotion today were not known in early 1935 when West Penn's commercial sales department decided to develop the market. However, the development of the residential electric cooking market was moving along very well, and it was evident that there were excellent revenue possibilities in commercial electric cooking. At that time one estimate valued 1 kw of commercial electric cooking as equivalent to one domestic electric range in new revenue produced. At the present time the commercial cooking kw is actually valued about 25% higher than the domestic range in revenue estimates.

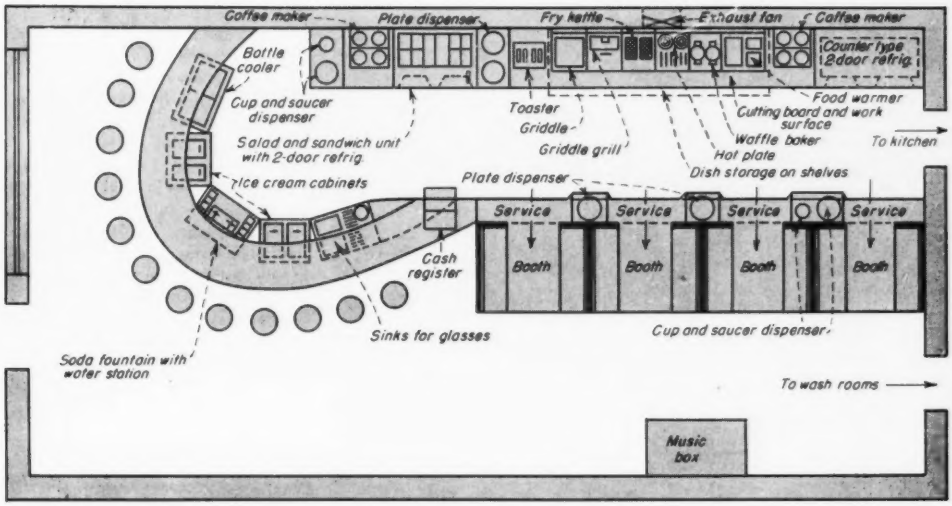
### Two Important Decisions

Two important decisions were made at the time West Penn began development of the commercial cooking market: (1) to concentrate effort initially on counter cooking equipment, (2) to place responsibility for cooking equipment sales on the commercial sales representatives in the field.

Counter equipment with its outstanding advantages and customer benefits offered much better possibilities than the heavy-duty equipment for breaking open the market. West Penn serves a territory in which low-cost natural gas of 1,100 to 1,150 Btu content (1948 average price—53¢ per 1000 cu ft) is available almost everywhere. The disparity in operating costs between gas and electric at a time of low customer acceptance for electric cooking was a deterring factor in promotion of heavy-duty equipment.

The decision to place sales responsibility for electric cooking on the commercial sales representatives in the field rather than on a cooking specialist was a very wise one. West Penn territory covers 8,700 sq mi. Had the development of the cooking market been assigned exclusively to one specialist in this widespread territory, progress would have been very slow. Instead, all-service commercial salesmen became cooking specialists through experience, and so accelerated acceptance of electric cooking in their territories.

Because of the successful experience with cooking schools or group demonstrations by the residential sales department, this method was




**COUNTER AND KITCHEN LAYOUT** are currently used by West Penn as an effective way to sell the all-electric kitchen idea. Layout above was prepared by commercial sales representative as solution to a layout problem during company training session

## what's new in cooking and kitchen layouts

chosen to introduce commercial electric cooking to food service customers. For a number of years these group demonstrations were one or two-day affairs held in six to eight different locations in the territory every spring. These demonstrations accomplished a number of things:

**1.** Many food service customers became acquainted with commercial electric cooking equipment for the first time by seeing it demonstrated and hearing of its advantages.

**2.** Many sales were made and prospects developed at these demonstrations.

**3.** Company commercial sales representatives received valuable training in equipment operation.

**4.** Other employees attended these demonstrations. Their interest and support was thus obtained in development of the market. They have supplied many leads on commercial cooking prospects over the years.

Another very successful method used in development of the cooking market has been the special sales activity. The first such activity covered a two-month period in the spring of 1936. Similar activities were held annually through 1941, when they were interrupted by World War II. It was not until 1948 that another such intensive sales activity was held, although a special 30-Day Fry Kettle Activity was held in February 1947.

### Types of Quotas

These Activities always used one or both of two types of quotas: (1) performance quotas, (2) result quotas. Performance quotas included contacts, demonstrations, and more recently, layouts submitted. Result quotas were in terms of total cooking kw installed. The 1936 activity put quotas on grill, fry kettle, and coffee maker demonstrations. This emphasis on demonstrations was a big factor in the 50% increase in fry kettle sales and the 900% increase in coffee maker sales over 1935. In 1937 and 1938 activity quotas were on cooking kw installed only. In 1939, however, emphasis was placed on waffle baker promotion with a demonstration quota and a kw installed quota. Waffle baker sales had lagged behind fry kettle sales. While the activity did not bring sales to the fry kettle level, it did result in a 50% increase over the previous year's sales.

Meat and sandwich grills and hot-food storage units received the same emphasis in 1940 because acceptance was lagging behind the leaders—fry kettles and coffee makers.

The promotional picture had changed considerably by the time the first postwar sales activity was scheduled in 1948. Performance quotas were set on contacts, demonstrations, and layouts submitted. An additional quota was set on new wiring capacity installed in food service establishments to emphasize the importance of adequate wiring in developing the cooking market. The contact quota was established mainly to broaden market coverage. During the war, field manpower has shrunk from 18 to 7, and had not approached prewar strength until 1948. With customer requests for our commercial representatives' services accounting for about 50% of their calls, much of the cooking market had been left untouched for several years.

The "layouts submitted" quota was used to emphasize the growing importance of kitchen planning in the promotion of electric counter and central kitchens.

This year—1949—quotas have been established on results only, on

**GENERAL KITCHEN** Caravagio's, Carmichaels, Pa., was laid out by West Penn salesman and a cooking equipment dealer. This 1948 job has a connected cooking load of 48.5 kw

a somewhat broader basis than prewar. Quotas set are for kw installed, kw sold, and kw recommended (by kitchen layout).

Group demonstrations in prewar years were always scheduled during the sales activity period and were an important factor in obtaining activity objectives. No bonuses or monetary incentives have been offered in any of the sales activities. The spurring of competition among the six operating divisions of the company has been sufficient to bring all activities to successful conclusions. The 1948 sales activity was an indicator of the importance of these activities to the year's results in cooking promotion; of the total cooking load installed during the year 47% was either installed or sold during the two-month activity period.

Sales tools have played an important part in West Penn's commercial cooking development. Foremost have been demonstration counter cooking equipment such as the fry kettle, meat grill, sandwich grill, griddle, waffle baker, coffee maker, and food warmer. Prewar, demonstration equipment was either purchased outright or obtained on consignment for limited periods. This equipment was used in demonstrations on the customer's premises.

Seemingly there has been less need for this type of demonstration in the recent postwar period. The rapid increase in customer acceptance of commercial electric cooking has made it unnecessary, in most cases, to use the demonstration to close sales.

Photographs of electric cooking installations have been used for a number of years as sales aids. While testimonial letters have been obtained occasionally, commercial sales representatives have preferred to take the prospect directly to the user.

Since the war, another sales tool—the cooking layout—has been given wider use in cooking promotion. Through its use, West Penn hopes to sell the idea of all-electric cooking. This is in contrast to the demonstration method, whereby jobs are sold piecemeal. Demonstration still plays an important part in closing many sales, but the layout helps to sell the idea of all-electric cooking.

### Direct Mail Advertising

Throughout the years of cooking promotion, West Penn has carried on a hard-hitting, consistent program of direct-mail advertising that has taken a variety of forms—letters, self-mailers, blotters, booklets, and postcards. For many years *Food Service News* has been sent regularly to a mailing list that includes 2,315 food service customers out of an estimated total of 4,034 food customers.

West Penn's commercial eight-page bi-monthly publication *What's New* always has devoted some space to electric cooking installations and is, of course, sent to the entire commercial mailing list of 10,500.

Since the war, four special bulletins 4 to 12 pages in length have been prepared on outstanding electric cooking installations. They describe the installations in some detail, pointing up customer benefits and furnishing pertinent data on types and number of meals served, and the cost of preparing them electrically.

An innovation this year is the use of a picture postcard of an installation that carries a brief message on the back.

Dealer cooperation has played an important part in developing the cooking market. West Penn has not merchandised commercial electric cooking equipment at any time since it began planned promotion in 1935. In the early days, there was only a handful of commercial electric cooking equipment dealers. Since the war, this number has grown until today between 40 and 50 dealer organizations cover all or parts of the company territory. Twenty-one dealers are located within the territory.

Commercial sales representatives have cooperated with dealers by furnishing them prospects, helping to close sales on dealer prospects, and following through on the provision of adequate wiring facilities and installation details. Both presale and postsale equipment demonstrations have been made for dealers.

### Company Service Activities

West Penn has devoted considerable effort to keeping equipment in operation and keeping customers sold on the merits of their electric equipment. In early days equipment breakdowns were few. Equipment was sent to service agencies in Pittsburgh for repair or returned to the manufacturer. As the amount of equipment in use grew, this method of handling equipment service proved too slow. Just before the war West Penn decided to go into the servicing of commercial electric cooking equipment. Service agreements were signed with Hotpoint Inc and Griswold Mfg Co. Repair parts were purchased and stocked. The volume of repair work

**COUNTER KITCHEN** at "R"-Place, Adamsburg, Pa., was installed in 1948 for combination curb, counter and table service. Connected cooking load is 37 kw. Sales representatives capitalize on these electric kitchens by taking customers to see them in operation

grew steadily during the war. Since new equipment was very difficult to obtain, maintenance of equipment was of importance.

Shortly after the war intensive two-day schools were conducted on the servicing of commercial electric cooking equipment by Hotpoint and Griswold for West Penn Service personnel. Expanded stocks of parts were located at the central storeroom in Conellsville, rather than in scattered district storerooms. Better inventory control was maintained in this way. Since the war, too, arrangements have been worked out with Pittsburgh service agencies to obtain replacement parts, on short notice, that were not available in West Penn stock when needed.

### Planned Kitchen Program

With the rapid acceleration in customer acceptance of electric cooking since the war, West Penn felt it timely to develop a new approach to the cooking market. The promotion of planned electric kitchens seemed to be the solution since it offered a medium for selling the all-electric kitchen idea.

Considerable training in food service equipment requirements and layout techniques was necessary before widespread use of the layout method could be made. Today, West Penn's commercial sales representatives and layout engineers have become adept at kitchen layouts and are making greater use of this tool in selling kitchen installations.

The planned kitchen program is aimed at both counter and heavy duty installations through promotion of electric counter and electric central kitchens. To provide some measure of accomplishment and establish agreement on what constitutes an electric kitchen installation, the following definitions have been set up.

### Electric Counter Kitchen

1. Must be located in the dining area.
2. Must provide at least five of the following facilities, including two of the first four:

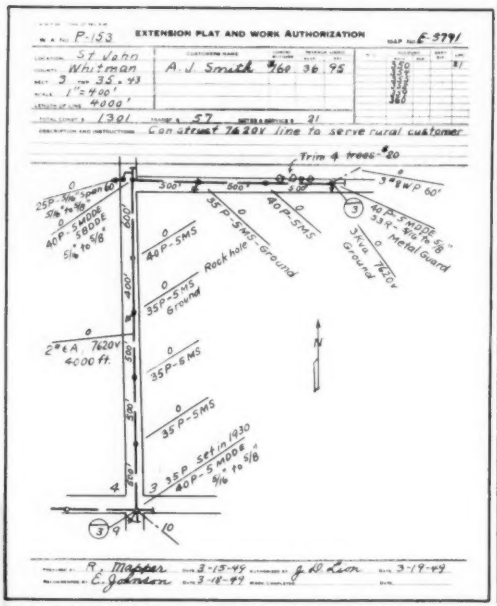
   a. Deep fat frying
   b. Sandwich and meat grilling
   c. Griddling
   d. Surface cooking
   e. Hot food storage
   f. Coffeemaking
   g. Toasting
   h. Broiling
   i. Waffle baking
   j. Dishwarming
   k. Roasting and baking

### Electric Central Kitchen

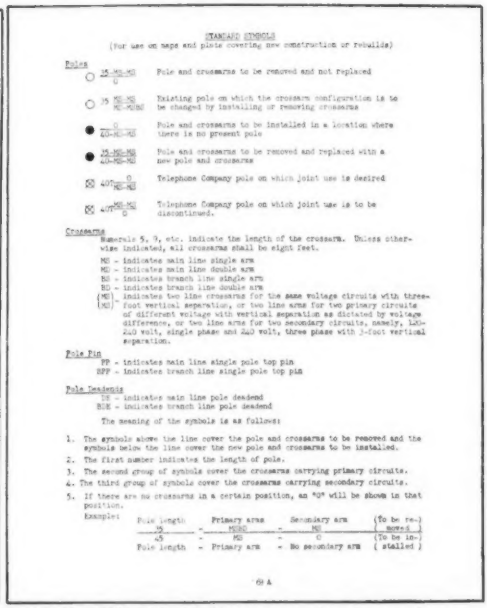
1. Must be located out of the dining area.
2. Must provide at least five of the facilities listed under the electric counter kitchen definition, including the following two facilities: (a) Surface cooking; (b) roasting and baking.

This promotion played an important part in 1948's accomplishments. A total of 45 electric kitchens were completed in 1948—29 counter and 16 central; accounting for new cooking load of 1,167 kw, or 26.4% of the total for the year. At the present time there are 94 electric counter and central kitchens in operation in West Penn territory—57 electric central kitchens and 37 electric counter kitchens—with connected loads totaling 3,857.5 kw.

It took West Penn six years to top the 1,000-kw mark in annual cooking sales. But with better nation-wide acceptance of electric cooking, both residentially and commercially since the war, it is likely that a beginner in commercial electric cooking promotion could expect more rapid development than that enjoyed by West Penn in the period from 1935-41. As far as West Penn is concerned, commercial electric cooking has proved itself a most important source of new commercial revenue, and with a potential of $2,000,000 in new revenue still to be realized, it promises to play a major role in West Penn's over-all commercial promotional program for many years.




**WORKING SKETCH** from which estimator tabulates material requirements and estimates cost, using table shown on page 103


STANDARD SYMBOLS
(For use on maps and plats covering new construction or rebuilds)
Poles
Pole and crossarms to be removed and not replaced
Existing pole on which the crossarm configuration is to be changed by installing or removing crossarms
Pole and crossarms to be installed in a location where there is no present pole
Pole and crossarms to be removed and replaced with a new pole and crossarms
Telephone Company pole on which joint use is desired
Telephone Company pole on which joint use is to be discontinued.
Crossarms
Numerals 5, 9, etc. indicate the length of the crossarm. Unless otherwise indicated, all crossarms shall be eight feet.
MS - indicates main line single arm
MD - indicates main line double arm
BS - indicates branch line single arm
BD - indicates branch line double arm
(MS) - indicates two line crossarms for the same voltage circuits with three-foot vertical separation, or two line arms for two primary circuits of different voltage with vertical separation as dictated by voltage difference, or two line arms for two secondary circuits, namely, 120-240 volt, single phase and 240 volt, three phase with 3-foot vertical separation.
Pole Pin
PP - indicates main line single pole top pin
BPP - indicates branch line single pole top pin
Pole Deadends
DE - indicates main line pole deadend
BDE - indicates branch line pole deadend
The meaning of the symbols is as follows:
1. The symbols above the line cover the pole and crossarms to be removed and the symbols below the line cover the new pole and crossarms to be installed.
2. The first number indicates the length of pole.
3. The second group of symbols cover the crossarms carrying primary circuits.
4. The third group of symbols cover the crossarms carrying secondary circuits.
5. If there are no crossarms in a certain position, an "0" will be shown in that position.
Example:
35 - MSRD - MS - (To be removed)
45 - MS - 0 - (To be installed)
Pole Length - Primary arm - No secondary arm
69 A

**GRAPHIC SYMBOLS** and abbreviations used to show complete information with minimum space and writing on sketch

# All-Inclusive Unit Costs Aid Line Cost Estimating

## Unit cost method makes estimating distribution line costs a routine clerical job

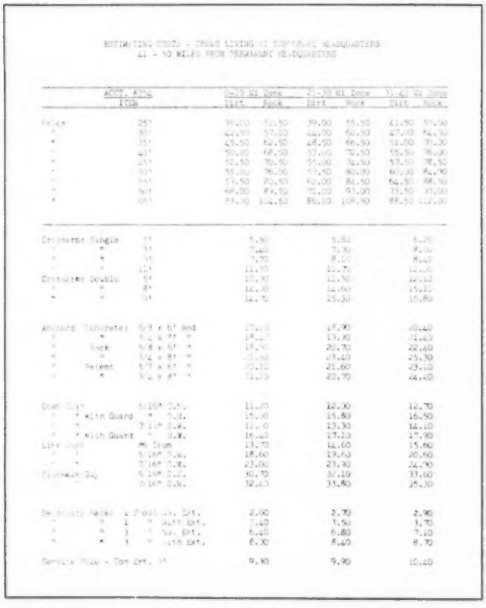
**EARL BAUGHN**
Electrical Engineer
Washington Water Power Co
Spokane, Wash.

UNIT ESTIMATING COSTS which include everything—transportation and living expenses for crews away from headquarters as well as labor and materials required—make estimating of distribution line construction costs a routine clerical job. The Washington Water Power Co has for some time used tables of estimating costs by units of property for any given distance from headquarters. This procedure has freed distribution engineers for other more technical work, and has meant substantial savings for the company.

Unit costs for estimating have been prepared from material costs and labor costs plus customary overhead for engineering and other general expenses. Work more than 30 miles from any of the company's ten crew headquarters is done by a crew which establishes temporary headquarters at the nearest suitable accommodations. Additional living expenses and weekend transportation to division headquarters are included in the unit costs.

Tables are prepared for each 10-mile zone beyond the 30-mile limit. Estimating of the job is then a simple matter of totaling the various units required (the same for any location) and multiplying by the unit cost for the location of the job relative to crew headquarters.

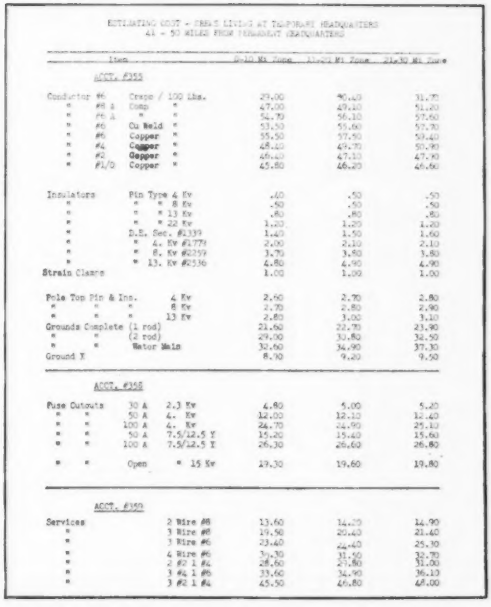
Various steps in handling a typical job are shown in the accompanying illustrations. In preparing an estimate the estimator simply tabulates material required and the appropriate unit cost figures as a routine operation. The bill of materials and authority for expenditure forms are prepared at the same time for necessary approval before the job is turned over to the division superintendent. When the job is finished and all charges accumulated, actual cost of the job is entered for comparison with the original estimate. Accuracy of this method of estimating has been consistently within 5% for both large and small jobs.



ESTIMATING COSTS - CREWS LIVING AT TEMPORARY HEADQUARTERS
41 - 50 MILES FROM PERMANENT HEADQUARTERS

| ACCT. #/Item | | Unit | 0-10 Mi. Zone Direct | 0-10 Mi. Zone Truck | 11-40 Mi. Zone Direct | 11-40 Mi. Zone Truck | 41-50 Mi. Zone Direct | 41-50 Mi. Zone Truck |
|---|---|---|---|---|---|---|---|---|
| Poles | | 25' | 39.00 | 51.50 | 39.00 | 53.50 | 41.50 | 55.50 |
| " | | 30' | 44.00 | 57.00 | 44.00 | 60.50 | 47.00 | 64.50 |
| " | | 35' | 49.50 | 62.50 | 49.50 | 66.50 | 53.00 | 70.50 |
| " | | 40' | 50.00 | 68.50 | 53.00 | 72.50 | 55.50 | 76.50 |
| " | | 45' | 62.50 | 79.50 | 65.00 | 84.50 | 69.50 | 89.50 |
| " | | 50' | 69.00 | 86.50 | 73.50 | 93.00 | 78.50 | 98.50 |
| " | | 55' | 76.00 | 97.50 | 80.00 | 101.50 | 86.00 | 107.50 |
| " | | 60' | 84.50 | 107.50 | 90.00 | 114.50 | 96.50 | 121.50 |
| " | | 65' | 93.50 | 118.50 | 99.50 | 126.50 | 106.50 | 133.50 |
| " | | 70' | 103.00 | 130.50 | 110.00 | 139.50 | 117.50 | 147.50 |
| " | | 75' | 113.50 | 144.50 | 121.00 | 153.50 | 129.50 | 162.50 |
| " | | 80' | 124.50 | 158.50 | 133.00 | 168.50 | 142.00 | 178.50 |
| " | | 85' | 136.00 | 173.50 | 145.00 | 184.50 | 155.00 | 194.50 |
| " | | 90' | 148.00 | 188.50 | 158.00 | 200.50 | 169.00 | 212.50 |
| Crossarms Single | | 8' | 5.30 | | 5.80 | | 6.20 | |
| " | " | 10' | 7.00 | | 7.70 | | 8.20 | |
| " | " | 12' | 7.70 | | 8.50 | | 9.10 | |
| " | " | 14' | 10.00 | | 10.70 | | 11.40 | |
| Crossarms Double | | 8' | 10.30 | | 11.30 | | 12.10 | |
| " | " | 10' | 14.00 | | 14.90 | | 15.80 | |
| " | " | 12' | 14.70 | | 15.80 | | 17.00 | |
| Anchors Telephone | | 5/8 x 6' Rod | 17.10 | | 18.90 | | 20.40 | |
| " | " | 3/4 x 8' " | 18.40 | | 19.90 | | 21.60 | |
| " | Rock | 5/8 x 6' " | 18.90 | | 20.70 | | 22.60 | |
| " | " | 3/4 x 8' " | 20.00 | | 21.60 | | 23.30 | |
| " | Patent | 5/8 x 6' " | 19.10 | | 21.60 | | 23.10 | |
| " | " | 3/4 x 8' " | 21.00 | | 23.70 | | 25.60 | |
| Down Guy | | 5/16" Str. | 11.00 | | 12.00 | | 12.70 | |
| " | " with Guard | " Str. | 15.00 | | 15.80 | | 16.50 | |
| " | " | 3/8" Str. | 15.00 | | 15.30 | | 16.10 | |
| " | " with Guard | " Str. | 16.40 | | 17.10 | | 17.90 | |
| Line Guy | | #6 Iron | 13.70 | | 14.60 | | 15.60 | |
| " | | 5/16" Str. | 18.60 | | 19.60 | | 20.60 | |
| " | " | 7/16" Str. | 23.00 | | 23.90 | | 24.90 | |
| Flexible Guy | | 5/16" Str. | 30.70 | | 32.10 | | 33.60 | |
| " | | 7/16" Str. | 32.60 | | 33.80 | | 35.30 | |
| Secondary Racks | 1 | Pole Str. Ext. | 2.00 | | 2.70 | | 2.90 | |
| " | 2 | " " Ext. | 5.60 | | 5.90 | | 6.70 | |
| " | 3 | " " Ext. | 6.20 | | 6.80 | | 7.10 | |
| " | 4 | " " Ext. | 8.30 | | 8.60 | | 8.70 | |
| Service Rack - Top Ext. | | | 9.30 | | 9.90 | | 10.60 | |

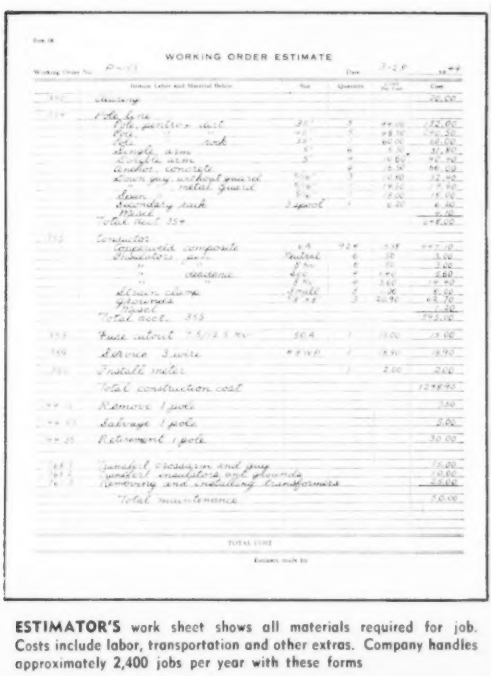
**ESTIMATING COSTS** tables used for various locations include factors, making total cost estimate a routine, reproducible figure



ESTIMATING COST - CREWS LIVING AT TEMPORARY HEADQUARTERS
41 - 50 MILES FROM PERMANENT HEADQUARTERS

| Item | | | 0-10 Mi. Zone | 11-40 Mi. Zone | 41-50 Mi. Zone |
|---|---|---|---|---|---|
| ACCT. #355 | | | | | |
| Conductor #6 | Copper / 100 Lbs. | | 29.00 | 30.40 | 31.70 |
| " #6 A | Comp. | " | 47.00 | 49.10 | 51.60 |
| " #6 A | " | " | 54.70 | 56.10 | 57.60 |
| " #6 | Cu Weld | " | 53.50 | 55.60 | 57.70 |
| " #6 | Copper | " | 55.50 | 57.50 | 59.60 |
| " #4 | Copper | " | 48.60 | 49.70 | 50.90 |
| " #2 | Copper | " | 46.60 | 47.10 | 47.70 |
| " #1/0 | Copper | " | 45.80 | 46.20 | 46.60 |
| Insulators | Pin Type 4 Kv | | .40 | .50 | .50 |
| " | " " 8 Kv | | .50 | .50 | .50 |
| " | " " 13 Kv | | .80 | .80 | .80 |
| " | " " 22 Kv | | 1.20 | 1.20 | 1.20 |
| " | D.E. Sec. #2339 | | 1.40 | 1.50 | 1.60 |
| " | " 4. Kv #2779 | | 2.00 | 2.10 | 2.10 |
| " | " 8. Kv #2359 | | 3.70 | 3.80 | 3.80 |
| " | " 13. Kv #2536 | | 4.80 | 4.90 | 4.90 |
| Strain Clamp | | | 1.00 | 1.00 | 1.00 |
| Pole Top Pin & Ins. | | 4 Kv | 2.60 | 2.70 | 2.80 |
| " " " | | 8 Kv | 2.70 | 2.80 | 2.90 |
| " " " | | 13 Kv | 2.80 | 3.00 | 3.10 |
| Grounds Complete | (1 rod) | | 24.60 | 22.70 | 21.90 |
| " " | (2 rod) | | 29.00 | 30.80 | 32.50 |
| " " | Water Main | | 32.60 | 34.90 | 37.30 |
| Ground Y | | | 8.70 | 9.20 | 9.50 |
| ACCT. #356 | | | | | |
| Fuse Cutouts | 30 A | 2.3 Kv | 4.80 | 5.00 | 5.20 |
| " " | 50 A | 4. Kv | 12.00 | 12.10 | 12.40 |
| " " | 100 A | 4. Kv | 24.70 | 24.90 | 25.10 |
| " " | 50 A | 7.5/12.5 Y | 15.20 | 15.40 | 15.60 |
| " " | 100 A | 7.5/12.5 Y | 26.30 | 26.60 | 26.80 |
| " " | Open | " 15 Kv | 19.30 | 19.60 | 19.80 |
| ACCT. #360 | | | | | |
| Services | 2 Wire #8 | | 13.60 | 14.20 | 14.90 |
| " | 3 Wire #8 | | 19.50 | 20.40 | 21.40 |
| " | 3 Wire #6 | | 23.40 | 24.40 | 25.10 |
| " | 4 Wire #6 | | 34.30 | 35.50 | 36.70 |
| " | 2 #2 1 #6 | | 28.60 | 29.80 | 31.00 |
| " | 3 #4 1 #6 | | 33.60 | 34.90 | 36.10 |
| " | 3 #2 1 #4 | | 45.50 | 46.80 | 48.00 |

**TYPICAL TABLE** covering ten-mile zones around a temporary headquarters between 41 and 50 miles from permanent headquarters



WORKING ORDER ESTIMATE

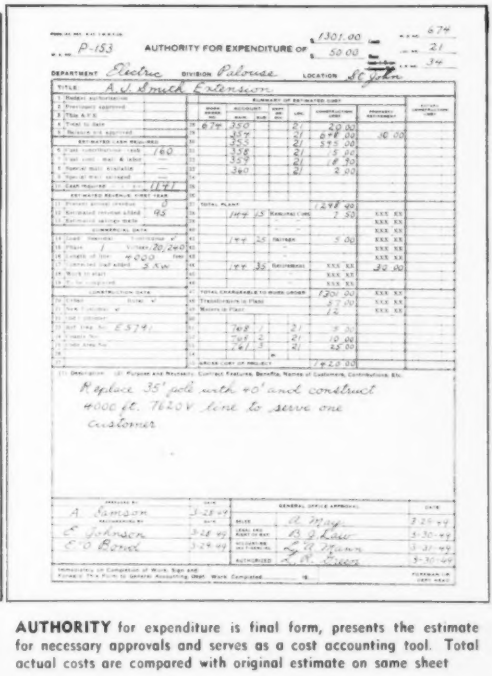
Working Order No. P-153 Date 3-29 19 49

| | Description Labor and Material Below | Size | Quantity | Unit Price | Cost |
|---|---|---|---|---|---|
| 350 | Clearing R/W | | | | 20.00 |
| 364 | 4 Pole Line | | | | |
| | Fifth position unit | 35' | 3 | 44.00 | 132.00 |
| | Pole " " | 40' | 5 | 48.50 | 242.50 |
| | Pole " " | 45' | 1 | 60.00 | 60.00 |
| | Shackle arm | 8" | 6 | 5.30 | 31.80 |
| | Shackle arm | 5" | 9 | 4.84 | 43.56 |
| | Anchor complete | | 3 | 15.50 | 46.50 |
| | Down guy without guard | 5/16" | 3 | 10.90 | 32.70 |
| | " metal Guard | 5/8" | 3 | 19.60 | 58.80 |
| | Stem | 5/8" | 3 | 2.10 | 6.30 |
| | Secondary rack | 2 spool | 3 | 2.20 | 6.60 |
| | Misc. | | | | 6.00 |
| | Total acct. 364 | | | | 618.26 |
| 365 | Conductor | | | | |
| | Copperweld composite | #4 | 924 | .338 | 312.10 |
| | Insulators pin | Natural | 6 | .50 | 3.00 | |
| | " " | Gray | 6 | .50 | 3.00 |
| | " neutral | Gray | 3 | 1.96 | 5.88 |
| | " " | Gray | 3 | 2.60 | 7.80 |
| | Strain clamp | Small | 3 | .80 | 2.40 |
| | Splicesleeves | 4 to 4 | 3 | 2.90 | 8.70 |
| | Ground | | | | 4.00 |
| | Total acct. 365 | | | | 346.88 |
| 366 | Fuse cutout 7.5/12.5 Kv | 50 A | 1 | 15.00 | 15.00 |
| 369 | Service 3 wire | #6 W.P. | 1 | 9.90 | 9.90 |
| 370 | Install meter | | 1 | 2.00 | 2.00 |
| | Total construction cost | | | | 1249.84 |
| 364 (1) | Remove 1 pole | | | | 2.50 |
| 364 (2) | Salvage 1 pole | | | | 3.00 |
| 364 (3) | Retirement 1 pole | | | | 30.00 |
| 365 (1) | Removal & reassign end guy | | | | 15.00 |
| 365 (2) | Removal insulators and grounds | | | | 10.00 |
| 365 (3) | Removing and installing transformers | | | | 20.00 |
| | Total maintenance | | | | 80.00 |

TOTAL COST

Estimate made by

**ESTIMATOR'S** work sheet shows all materials required for job. Costs include labor, transportation and other extras. Company handles approximately 2,400 jobs per year with these forms



AUTHORITY FOR EXPENDITURE OF $ 1301.00 W.O. No. 674
W.O. No. P-153 $ 50.00 Dist. No. 21
DEPARTMENT Electric DIVISION Paloma LOCATION St. John Dist. No. 34

TITLE A.V. Smith Extension

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 1 Project authorized | | | | | | | | |
| 2 Previously approved | | | | | | | | |
| 3 This A.F.E. | | | | | | | | |
| 4 Total to date | | | | | | | | |
| 5 Balance not approved | | | | | | | | |
| ESTIMATED CASH REQUIRED | | | | | | | | |
| 6 Cost construction - cash | 160 | | | | | | | |
| 7 Cost cont. mat. & labor | — | | | | | | | |
| 8 Special mat. salvage | | | | | | | | |
| CASH required | 160 | | | | | | | |
| ESTIMATED ACCRUAL COST ITEM | | | | | | | | |
| 9 Project appro. invoice | 0 | | | | | | | |
| 10 Estimate other cost | 98 | | | | | | | |
| 11 Estimate salvage data | | | | | | | | |
| COMMERCIAL DATA | | | | | | | | |
| 12 Load Transfer | | | | | | | | |
| 13 Poles | 1 | | | | | | | |
| 14 Length of line | 4000 | | | | | | | |
| 15 Conductor size | 2 #6 | | | | | | | |
| 16 Watts to start | | | | | | | | |
| 17 Load connected | | | | | | | | |
| CONSTRUCTION DATA | | | | | | | | |
| 18 Total | | | | | | | | |
| 19 Transformers in Place | | | | | | | | |
| 20 Meters in Place | | | | | | | | |
| 21 Cost - Labor | | | | | | | | |
| 22 Cost Trans. & Equip. | E574 | | | | | | | |
| 23 Cost Misc. | | | | | | | | |
| 24 Total Cost | | | | | | | | |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 674 | 1 | 20.00 | | 21 | 20.00 | | | |
| | 354 | | | 21 | 698.00 | | 16.00 | |
| | 355 | | | 21 | 575.00 | | | |
| | 356 | | | 21 | | | | |
| | 359 | | | 21 | 8.30 | | | |
| | 360 | | | 21 | 4.20 | | | |
| | | | | | | | | |
| | | | | | 1298.00 | | | |
| | 144 | 35 | Remaining Life | | 7.30 | | XXX | XX |
| | | | | | | | XXX | XX |
| | | | | | | | XXX | XX |
| | 144 | 35 | Salvage | | 5.00 | | XXX | XX |
| | | | | | | | XXX | XX |
| | | | | | | | XXX | XX |
| | 44 | 35 | Retirement | | XXX | XX | 32.50 | |
| | | | | | XXX | XX | | |
| | | | | | XXX | XX | | |
| | | | TOTAL CHARGEABLE TO WORK ORDER | | 1320.00 | | XXX | XX |
| | | | Transformers in Place | | 57.00 | | XXX | XX |
| | | | Meters in Place | | 14 | | XXX | XX |
| | | | | | | | | |
| | 168 | 1 | | 21 | 10.00 | | | |
| | 361 | 3 | | 21 | 14.00 | | | |
| | | | | | | | | |
| | | | GRAND COST OF PROJECT | | 1420.00 | | | |

(1) Description (2) Purpose and Necessity, Contract Features, Benefits, Names of Customers, Contributions, Etc.

Replace 35' pole with 40' and construct 4000 ft. 7620 V line to serve one customer

| PREPARED BY | DATE | GENERAL OFFICE APPROVAL | DATE |
|---|---|---|---|
| A. Simson | 3-28-49 | | |
| RECOMMENDED BY | | | |
| E. Johnson | 3-28-49 | | |
| APPROVED BY | | | |
| C.O. Bond | 3-29-49 | | |

Immediately on Completion of Work Sign and Forward This Form to General Accounting Dept. Work Completed 19 FOREMAN OR DEPT. HEAD

**AUTHORITY** for expenditure is final form, presents the estimate for necessary approvals and serves as a cost accounting tool. Total actual costs are compared with original estimate on same sheet

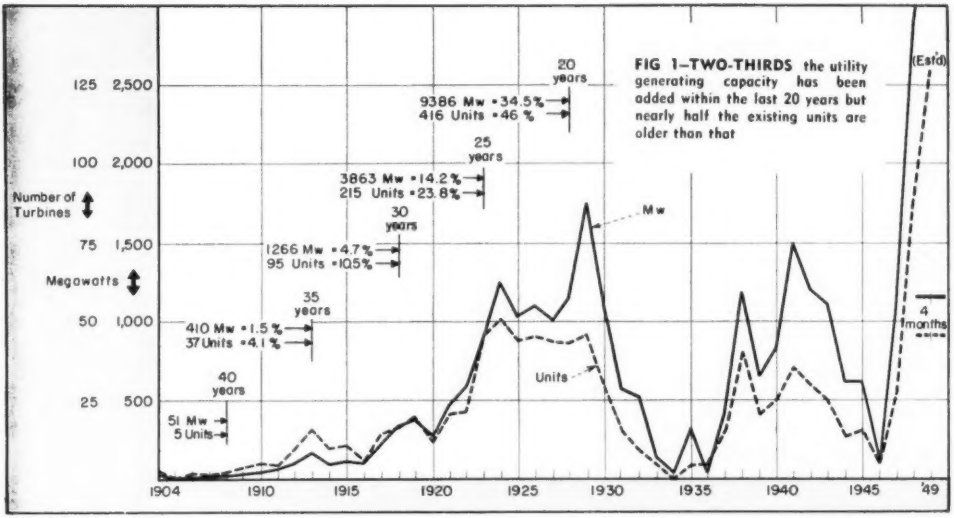



**FIG 1—TWO-THIRDS** the utility generating capacity has been added within the last 20 years but nearly half the existing units are older than that

# Service Ages of Utility Boilers

**A two-thirds sampling shows one in three generator megawatts and one in four boiler capacities to be over 20 years old. Half the turbines and two-thirds the boilers are that old or more**

NEARLY A THIRD of the steam turbine generating capacity and over one-fourth of the boiler capacity in US utility plants are over 20 years old. About one-seventh of the generator capacity is over 25 years old and so is over one-tenth of the boiler capacity. In terms of units nearly half the turbogenerators and nearly two-thirds the boilers are more than 20 years old. Also nearly one quarter of the turbines and nearly a third of the boilers are more than than 25 years old.

These approximations are based on data filed with the Federal Power Commission by 122 utilities for 200 plants. The aggregate in generating capacity represented up to May 1, 1949, is 27,155,340 kw and this is better than two-thirds the total fuel generation capacity in the country. The data for boilers are available only up to January 1, 1948.

Only units (turbines and boilers) still functioning are included in the tabulation and analysis. The retirements reported by the FPC during 1948 and thus far in 1949 amount to 67,240 kw but none of the items pertain to the specific plants included in the table; retirements are mostly municipal units under 4,000 kw.

An appreciable amount of boiler and turbine capacity is 30, 35 and 40 years old as indicated by the accompanying tabulation.

None of these assertions are to be construed as indicating that equipment older than any specified age is palpably obsolete and should be superseded by new and modern equipment. Continued use of this early equipment is warranted for peak load and emergency operation even though the fuel rate is high provided the reliability is there for intermittent use, and upkeep is not inordinate.

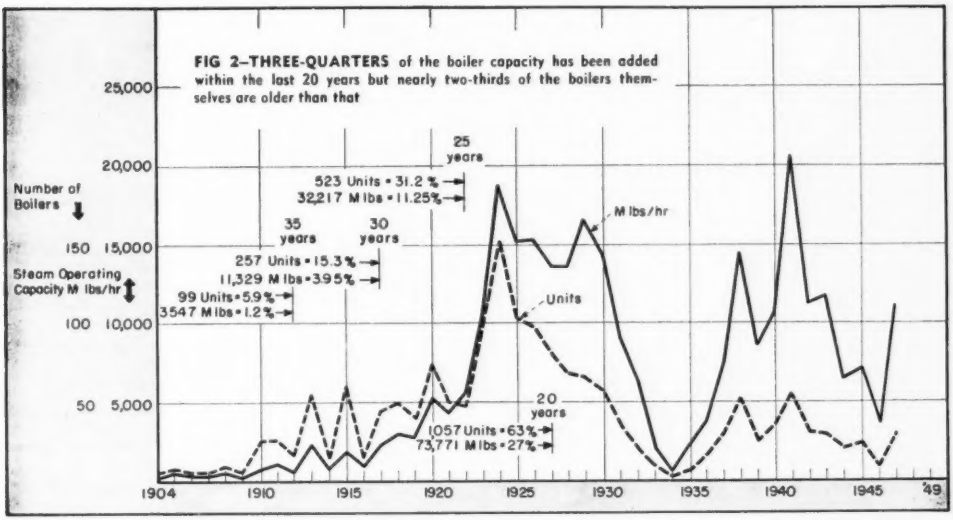
**Percentage of Total by Age**

| Age More Than | Turbines No. | Turbines Capacity | Boilers No. | Boilers Capacity | Pounds per Kwhr Best | Pounds per Kwhr Aver |
|---|---|---|---|---|---|---|
| 20 years | 46 | 34.5 | 63 | 27 | 1.43 | 2 |
| 25 years | 23.8 | 14.2 | 31.2 | 11.25 | 1.53 | 3 |
| 30 years | 10.5 | 4.7 | 15.3 | 3.95 | 2.20 | 4 |
| 35 years | 4.1 | 1.5 | 5.9 | 1.2 | 2.40 | 5 |
| 40 years | 0.18 | 0.18 | 0.23 | 0.25 | ? | 6 |

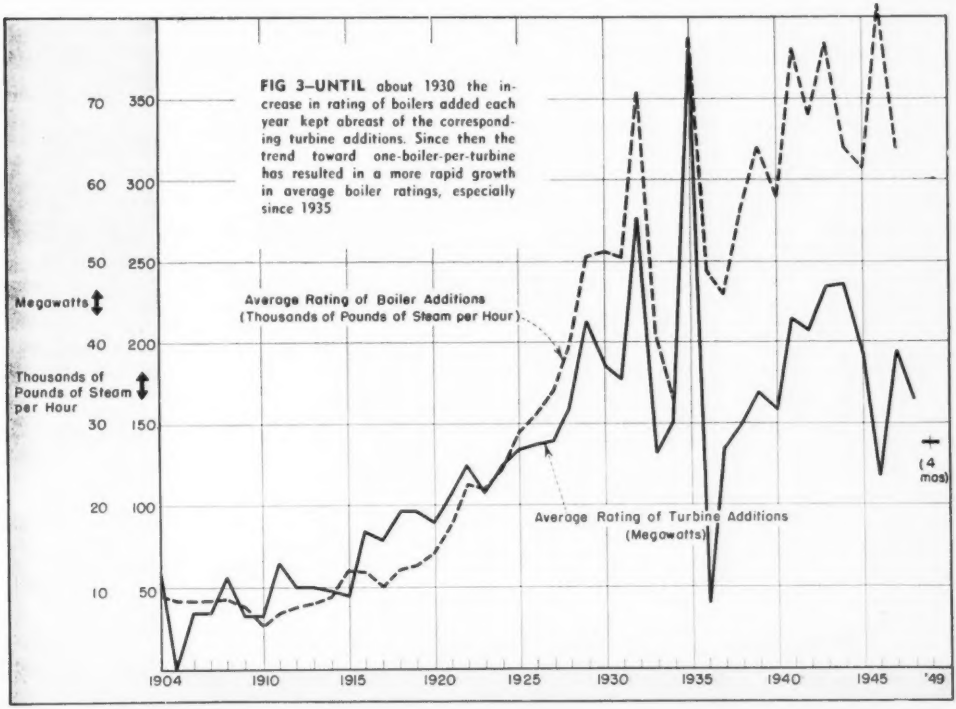
Most of the old turbine units still kept available for service consume fuel (for the hours they are operated) at rates several times as high as current units.

It will be noted that a higher percentage of the boilers exists for any of the age brackets than for turbines. This is due to the retention of a multiplicity of older boilers to serve (usually) older and lower pressure turbines and to the recent vogue of one-boiler-per turbine plant designs. Most of the older boilers are naturally stoker-fired.

That there are considerable numbers of both boilers and turbines that warrant critical analysis to determine the justification of their indefinite retention is quite obvious from the data presented.




# and Steam Turbines



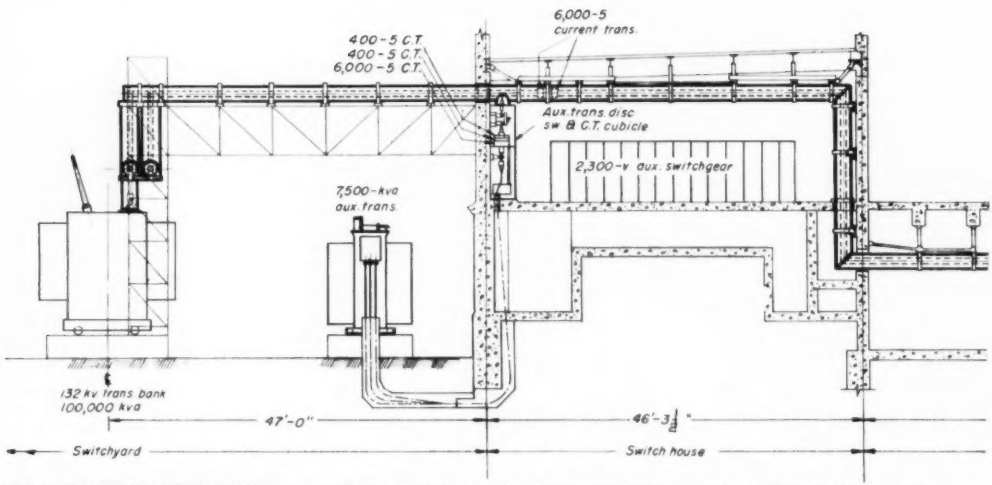



**FIG 1—PHASE ISOLATION DUCTS** are carried from the generator in the turbine room, right, to 100,000 kva step-up transformer bank, left. Current transformers are within the isolating ducts and taps are made to auxiliary transformer and generator surge equipment cubicle

# Complete Phase Isolation—Generator To Transformers

**Isolated phase duct from generator through switch house to switchyard incorporates taps for generator surge protection, taps to auxiliary transformer, and current transformers for generator differential protection and metering**

J. W. HANSON, Senior Engineer, Cincinnati Gas & Electric Co, Cincinnati

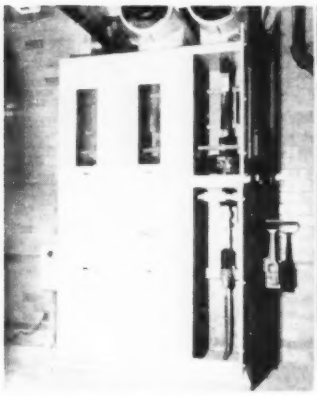


**FIG 3—TAP** to the 7,500-kva auxiliary transformer is carried through this tap-off cubicle which houses gang operated disconnect switch and three sets of current transformers immediately inside the building

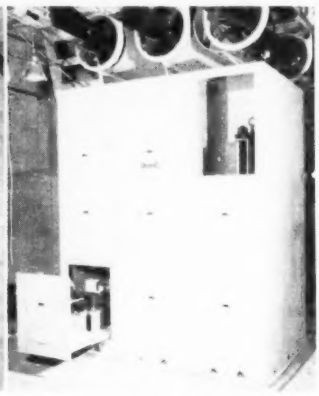
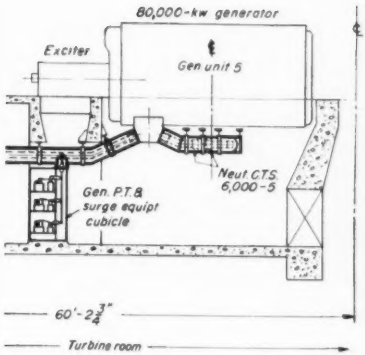


**FIG 4—LIGHTNING ARRESTER** and capacitor protective combination and two sets of potential transformers are housed in the cubicle shown here, which is located adjacent to line terminals of the generator

COMPLETE phase isolation is maintained throughout the structure carrying generator leads from the 30,000 kva Unit 5 of the Miami Fort Station to the 13.2/132 kv step up transformer bank in the switchyard. Housings and supporting structures are grounded. Current flowing in a line-to-ground fault is limited to 7 amp and this assures negligible damage within the structure in case of insulation failure. There are no circuit breakers between generator and step-up transformer bank. Main conductors, when installed and carrying rated current of 5,000 amp are designed for a maximum temperature rise of 45 C.

In addition to generator leads the phase isolation structure provides for connection of generator surge protective equipment and potential trans-



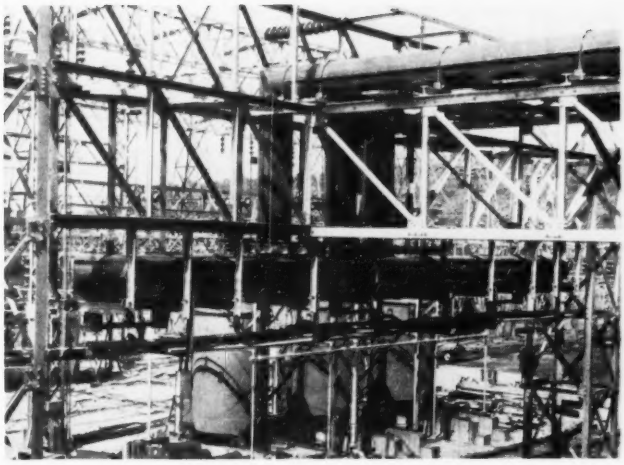



**FIG 2—ISOLATED PHASE CONSTRUCTION** was carried outdoors to the switchyard where connection was made to the 100,000-kva step-up transformer bank

formers. Structures are designed for Withstand Tests of 50-kv, 60-cycle and 110-kv impulse crest. Complete equipment was furnished by I T E Circuit Breaker Co.

Delta connection to the 100,000-kva main transformer bank is made in ducts supported over the transformer bushings, extreme left in Fig 1. Connections of leads between the transformer and its high and low voltage terminals are arranged so as to simplify this duct work. This structure, complete and ready for connection to the power transformers, is shown in Fig 2. Tap connection to the 7,500-kva transformer is immediately inside the building.

Cubicle housing lightning arrester and capacitor protective combination and two sets of potential transformers, Fig 4, is adjacent to line terminals of the generator. Adjacent to the neutral terminals is the duct in which the actual neutral connection is made. Current transformers for the generator differential protection and metering are located in the duct runs to the transformer and in the neutral section as shown in Fig 1.

The generator neutral is grounded through a transformer with a resistor in the secondary which in combination with the protective capacitors limits ground current. A voltage relay connected across the current limiting resistor is used to detect and clear any faults to ground which may occur with no intentional time delay.

Protection for clearing all faults other than faults to ground is provided by three sets of current differential relays. One set of relays is connected for protection of the generator only, one set for the unit auxiliary transformer only, and one set for over-all protection of the high voltage circuit breakers, main transformers, duct run and generator.

For auxiliary transformer differential protection 400-5 ratio current transformers were required. As the maximum symmetrical short circuit current at this point is 85,000 amp these transformers are of special design to meet the mechanical strength and thermal capacity required for this duty. They are through-type similar to the 6,000-5 amp transformers in the main bus run.

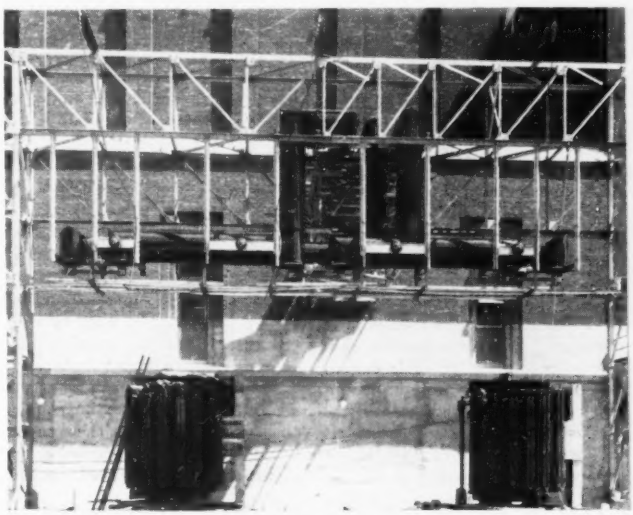


**FIG 5—ISOLATED PHASE DUCT WORK** has been completed to the transformer bank outdoors where this view shows it ready for connections to be completed

# Unit Substation Maintenance Easier With Mobile Reserve

**Planning a substation carefully can make the use of mobile substations for maintenance easier. Author lists design precautions to be observed**

P. R. PIERSON
Manager, Metal-Clad Switchgear Engineering
Westinghouse Electric Corp
East Pittsburgh, Pa.

MAINTENANCE of unit type substations can be done easier and with less inconvenience to customers if a mobile substation can be used to maintain temporary service. Observation of a few simple precautions in the layout and design of a unit substation will make its coordinated use with a mobile substation as simple with metal-clad switchgear as it is with structural-type substations.

The greatest service of the mobile substation is obtained when maintenance work is required on the main substation transformer and the temporary service source must supply all the power needs of the station. Another important function is the maintenance of service to an important feeder circuit while its normal circuit breaker is down for inspection and maintenance.

In both these instances coordinated operation of mobile and unit substations focuses attention on the provision and arrangement of connection and disconnection facilities.

### Accessory Needs

Accessories needed for connecting the temporary supply to the substation equipment consist of a low-voltage cable disconnecting device which is essentially the frame work of a metal-clad disconnecting breaker with the circuit breaker itself omitted. Cable from the mobile substation is connected to the disconnecting contacts so that when the cable disconnecting device is pushed into a breaker housing, from which the breaker has been removed, contact will be made either to the feeder bus or to an outgoing feeder.

The unit substation main transformer must be provided with some means for disconnecting it from its high-voltage supply with devices at least suitable for interrupting the magnetizing current. Associated switchgear must be metal-clad with disconnecting-type circuit breakers and include, besides the circuit breakers for control of feeders, a circuit breaker for disconnecting the transformer secondary from the bus. A dummy disconnecting device, consisting of a removable unit with bus and line contacts jumpered together, can be substituted for the transformer circuit breaker for limited requirements in radial feeder stations.

### Servicing Feeder Breakers

The highest degree of service continuity is obtained when the unit substation switchgear includes, in addition to the above, a section in which the cable disconnecting device can be inserted to connect the cables from the mobile substation to the unit substation bus. The mobile substation in Fig 1 is shown connected to the primary supply with hot-line clamps and to the switchgear bus through such a cable disconnecting device. Thus the mobile substation transformer can be energized and the main transformer paralleled by closing the disconnecting switch and secondary breaker. The main transformer is then isolated for maintenance by opening its secondary breaker and primary switch. This can be accomplished without service interruption on the switchgear bus. The transformer, transformer breaker and associated relays can be inspected, serviced, and tested at this time.

Feeder breakers can be serviced and tested using this same connection by substituting the transformer breaker; if they are interchangeable. Another way to service feeder breakers is to supply each individual feeder in turn from the mobile substation by replacing the normal feeder breaker with the cable connecting device while the rest of the substation feeders are supplied from the main substation transformer. Both methods involve two momentary interruptions to the feeder service. The use of the mobile substation to supply the feeder has the advantage of permitting a more complete check of the feeder relaying system.

### Two Power Sources

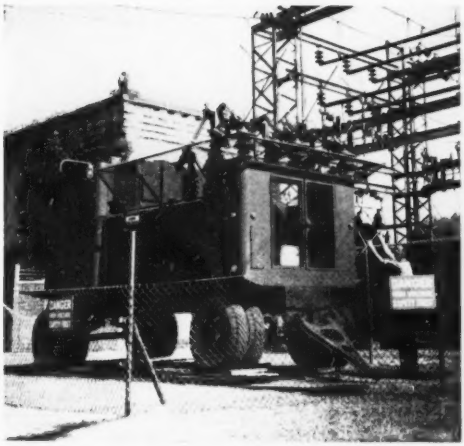
Another scheme, shown in Fig 2, is applicable to stations where one feeder supplies a large block of power, such as an industrial plant, which has two or more sources of supply. Existence of two power sources permits one supply feeder to be shut down or, if possible, connected temporarily to another feeder. The feeder section released in this way can then be used for connecting the mobile substation to the switchgear bus. Maintenance can then proceed as in the first example.

### Planned Interruption

At unit substation locations where planned momentary interruptions of service are permissible a third combination of equipment as shown in Fig 3 can be used. Here a dummy disconnecting device for disconnecting the transformer from the switchgear bus is substituted for the circuit breaker.

The steps in the use of this arrangement are:

1. Connect mobile substation to primary service.
2. Prepare substation for service.



**Mobile Substations can be used with unit type substations as easily as with structural type substation if means are provided to make the temporary connections**

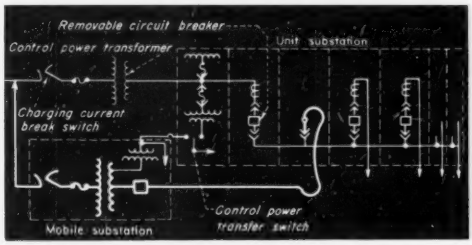



**FIG 1—SEPARATE POSITION** available on feeder bus of unit sub permits mobile substation to replace main transformer without interrupting service by opening secondary breaker and primary switch

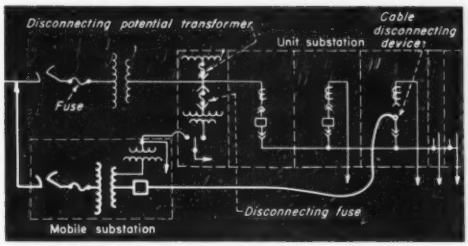



**FIG 2—MOBILE SUBSTATION** can be connected to the switchgear bus through a feeder position of bus type substation by means of cable disconnect device provided feeder has another supply source

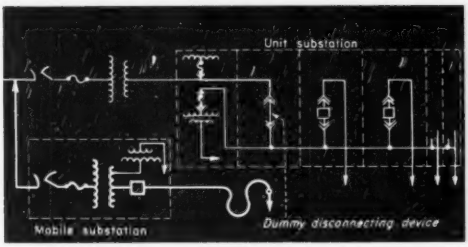



**FIG 3—DUMMY DISCONNECTING DEVICE** can be used in isolating main transformer and for connecting mobile substation to bus with no breaker between substation transformer and feeder bus

3. Open all feeder breakers to remove load from bus.

4. Remove dummy disconnect device thus disconnecting the transformer from the bus.

5. Insert cable connecting device in the transformer disconnect housing.

6. Close mobile substation breaker energizing bus.

7. Close feeder breakers restoring service.

8. Perform required maintenance operations.

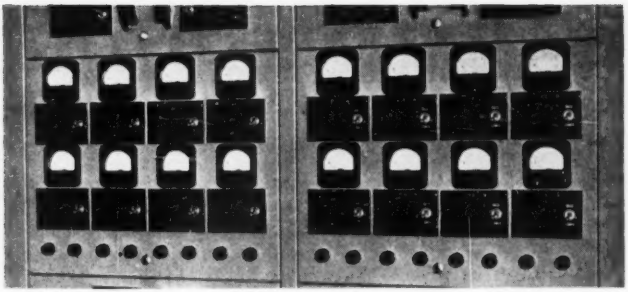
Restoring the station to normal supply from its own transformer requires a reversal of this procedure and another momentary service interruption.

The approximate increase in cost of a unit substation which will coordinate with a properly planned mobile substation for maintenance operations is shown in the following table. Switchgear costs for a typical four-feeder radial station with no transformer disconnecting means is considered as 100%.

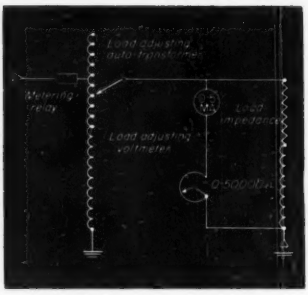
| *Scheme* | *Percentage Cost Increase* |
|---|---|
| 1. Transfer of service to mobile unit without service interruption | 30% |
| 2. Transfer of service to mobile unit with service interruption on one feeder for duration of maintenance operation. | 22% |
| 3. Transfer of service to mobile unit with momentary service interruptions on all feeders when connecting and disconnecting mobile unit. | 12% |

It will be noted that all the above schemes use the same mobile substation assemblies. This permits each unit substation to be laid out to suit economic and system requirements of the area served.

In general, the mobile substation should consist of a transformer rating which is consistent with the largest kva load that must be kept in service with due regard for weight and dimension limitations of highways. Associated primary control usually consists of air-break disconnecting switches with horn gaps for interrupting transformer magnetizing current and power fuses for fault protection. The secondary circuit breaker will be chosen on the basis of maximum duty; for radial system this will depend largely on associated transformer characteristics. For network or parallel-feeder operations effects of reverse power will need consideration. Protective relays, metering, control for the circuit breaker and sources of auxiliary power should be chosen for the type of service expected. Coordination of all mobile substation equipment should be considered carefully, as the value of such a unit depends on its use factor and that in turn depends on its mobility.



**SMALL VOLTMETER** for each load circuit saves time on a-c network calculators; otherwise a master instrument would have to be inserted in each circuit to check its values




**MILLIAMMETER** and rheostat serve as load-adjusting voltmeter at Georgia Tech

# Load-Adjusting Voltmeters Speed Up Calculator Operation


**H. P. PETERS**
Supervisor
A-C Network Calculator Laboratory
Georgia Institute of Technology, Atlanta


WITH THE recent addition of load-adjusting voltmeters, the a-c network calculator at Georgia Tech is the first large calculator in the country to utilize all of the time-saving improvements developed for such boards. Chronologically, the seven major improvements are: (1) Logical grouping of equipment, 1933; (2) circuit selectors (electrically operated metering relays), 1938; (3) scalar instruments, 1939; (4) load adjusters, 1940; (5) direct reading wattmeters, 1942; (6) plotting tables, 1945; and (7) load-adjusting voltmeters, 1947.

The load-adjusting voltmeter development probably is the least known so the reason for its use follows. As a calculator study progresses from one condition to the next, voltage on the load busses varies. But since the load power and power factor must be maintained constant, it is necessary to check and readjust the loads one or more times during the set-up of each condition. This adjustment is easily made on calculators that have load-adjusting autotransformers. The load circuit is merely connected to the master instrument and the autotransformer taps adjusted until the voltage on the load impedance is the same as it was originally. Thus the load will draw the same power. Although the process is simple, it takes time to insert the master instrument into each load circuit to check its values.

To eliminate the necessity of inserting a master instrument into each load circuit a voltmeter is used with each load circuit. Then, if the voltage across the load impedance is maintained constant, the load will automatically draw the correct power and reactive power.

Since the instrument burden is part of the load, the voltmeter should have a low burden so that a limitation is not set on small loads. The instrument should also be free of temperature or aging errors. The first of these requirements would indicate a rectifier type instrument, the second would preclude its use.

The first two installations of load-adjusting voltmeters used special 3-in. instruments with adjustable pointers. The pointers were set at the correct voltage and the indicating pointer made to line up by means of the load-adjusting autotransformer. One of these installations used instruments with a suppressed zero. The third installation utilized a 2-in. instrument (milliammeter) with a calibrating rheostat and a single marked point on the dial. A small current transformer permits usage of a standard 100 ma iron-vane instrument.

Drawing on this experience, Georgia Tech installed a unique load-adjusting voltmeter scheme on the 60 load circuits of its a-c network calculator. A standard two-inch milliammeter, with five milliamperes required for full-scale deflection, was used. This was the lowest-range, standard iron-vane instrument available. In effect the instrument is a voltmeter with an adjustable 50,000 ohm calibrating resistance.

The dial of the instrument is marked at two points. For the normal calculator base of 100 v, the lower of these two marks (about 2.8 ma) is used. This current is low enough so that it has little effect on the minimum load that can be set up. This lower mark can be reached with voltages as low as 40 v in case a 50-v base is required. For the unusual condition when a 200-v base is used on the calculator, a second mark at about 4.5 ma is used. Instruments are located adjacent to load-adjusting autotransformers, rheostats grouped at bottom of panel.

On the basis of low cost, ease of installation and minimum disturbance of the original equipment, the installation probably is the best installed to date. Also, experience has dispelled preliminary doubts as to the accuracy of the 2-in. instruments.

# Sidelights on Rural Load Building

## Low cost ratios of electric service to farm totals form incentives to increase usage of power—"Grass roots" contacts invaluable

**RALPH J. BUGBEE**
Director Farm Department
Central Vermont Public Service Corp
Rutland, Vt.

WITH FEW EXCEPTIONS the rate per kwhr charged for electric service is a minor consideration of the farmer. Today he wants plenty of power available, uninterrupted service and reliable electrical equipment. Electric service is so far ahead of any other type of power that it can successfully compete on practically any reasonable rate schedule. In general, the weak point in our national load building program has been ignorance of the uses farmers can make of electric service. We know now of about 25 uses being profitably employed, and more are coming in daily.

Central Vermont Public Service Corp hopes to complete about 100% rural coverage this year. We are now serving almost three times as many farms as in 1935, and the average yearly energy consumption has risen from about 1,000 to nearly 3,000 kwhr. In spite of the fact that our rates are not the lowest in our state, our use per customer is higher than the average of any section of the United States except the far West where irrigation pumping is used.

### Farm Power's Low Cost Ratio

The electric bill of the farmer, like that of the average manufacturer, is a very small percentage of his total expenses. The University of Vermont recently found that the average Bennington County farmer had a total investment in his business in 1947 of $25,000, and expenses of $8,577. Of the expenses his electric bill for both farm and home averaged $91, or 1.06% of the total. It is probable that the investment in electrical equipment and wiring represents less than 10% of the farmer's total. Electrical equipment is used daily. Many items of farm equipment can be made more efficient by the simple process of changing the power used to electricity. Where for 1% of the total operating cost can so much be obtained.

### Typical Electric Farm "Tools"

I know of no better way to bring out the efficiency and economy of electric service than to list a farmer's uses for such power and then to try figuring out some other way to do the same thing. For example, milk can be cooled satisfactorily by ice, but what is involved? There is an initial investment in an insulated tank and an ice house or other storage space. Then there is the cost of ice purchased and either delivered to the house by the dealer, or cut and hauled by the farmer's own labor. Melting loss often reaches 50%. Twice-a-day labor must get the ice ready for the tank. Without fresh ice one or more cans of milk may be rejected at the plant.

In contrast there is the electric cooler. This requires one investment in equipment (usually less than for an ice tank plus an ice house) plus a monthly power bill and occasional servicing charges. Generally 1 kwhr per day will cool a 10-gal jug of milk and will do it quickly. The only labor involved is getting the cans into and out of the tank, as in any method. A power charge of less than $1 per month per can eliminates all other labor items mentioned above. Such an analysis as this has made milk cooling by electricity an accepted procedure on practically all Vermont dairy farms today.

Similar analyses can be made for virtually every piece of electrical equipment in the home and on the farm, with favorable results for electricity. Hand milking has become a lost accomplishment. The safety of the electric motor has made many a farmer and insurance company rest easier after the gas engine was replaced. The gas engine for the milker is now a show piece, used only on those rare occasions when the power goes off at milking time.

Above all else, electricity has made possible the use of automatic equipment. Through the use of thermostats, solenoids, switches and gages, electrical apparatus has become almost human in its work. The water pump, brooder, water heater, electric eye and milk cooler are but a few such items. Public meetings, schools, exhibits, radio talks and demonstrations help to build acceptance of electric service. The cost of such contacts is relatively small. One person reaches a large number at one time with minimum travel and expense. Such efforts give certain types of people a chance to air their "gripes" and get honest answers. They also provide a wonderful opportunity to tell people about company problems, giving those who really want to know a chance to find answers to their questions at the time or afterwards. Cooperation with farm extension service is also invaluable.

### Must Know Farm Picture

A successful farm load building program requires that those carrying it forward know not only the technical side of the problem of power supply, but also have a real understanding of the general farm picture, trends, prices, markets and natural resources. This means close knowledge of regional conditions and of the relative importance and values of local crops and markets cultivated intensely. The ratio of forest to crop lands, and the industrial potentialities allied with agriculture must also be taken into consideration. The past few years have seen less and less farmers pro-

(*Continued on page 165*)

From a recent discussion before the New England Association of Electric Co-Operatives at Holyoke, Mass.

**AUTHOR, CLARENCE W. SHERMAN,** (Second from left) explains punch system and accounting process which permits quick and accurate spot check on employees

# Personnel Accounting; It Packs A Punch!

**C. W. SHERMAN**
Personnel Officer
Puget Sound Power & Light Co
Seattle, Washington

WITH THE WAR came added responsibilities in the field of personnel administration. It was at this time that we felt the need for a more adequate system of compiling personnel studies. Many hours of labor and research were used in an attempt to see what our coming policy would be in regard to various phases of personnel administration.

To comply with a continual request for personnel studies and for our own use in speeding up our personnel administration, we kept in mind the possibility of a change to machine accounting to obtain a much desired improvement. It wasn't however, until early 1947 that we were able to sign contracts with the International Business Machines Corporation for lease of two machines for this purpose—a print punch and a card counting sorter. Like everything else, the deliveries were slow, but by December 1946 we were led to believe that we could expect the machines to be delivered sometime early in 1948.

With this in mind we set out to establish a personnel accounting system within our department. The establishment of this system was to provide: (a) Accurate sources of information for over-all planning and improved utilization of personnel, (b) simple, comprehensive procedures for administering various personnel functions, (c) eventual mechanization of the entire system of personnel functions.

### Building from Scratch

Building the system from scratch, we started out slowly and developed a personnel statistics card which would most adequately meet the needs of our department and Company in future personnel studies.

On this card we attempted to put basic information that was essential in reflecting the individual's background, education and training, together with his present location and job classification. Informing our employees of the job we were trying to do enabled us to get 100% cooperation in our efforts to supplement the information available in our personnel files. It was necessary that all information be accurate as well as up-to-date.

### Time Saver

With the assimilation of all available material, we soon had our personnel statistics file set up and ready for operation. This put us in a position to run personnel studies for any purpose we feel the Company might desire. Through the establishment of this system we have saved a considerable amount of time in routine studies, but possibly the greatest advantage is the accuracy with which the studies are completed.

Gradually we have been able to increase the use of these machines to include a number of personnel functions. This Company provides a sickness and disability allowance for regular employees who are off ill, which involves considerable record keeping. Through the use of the IBM machines we have put this information on punch cards. Each quarter we make a summary for distribution to the various division managers for their guidance, and at the end of the year a yearly summary is compiled, which gives the over-all picture of the sickness and disability benefits received by our employees. By various methods of sorting we are able to make various analyses of these figures compiled as to the individual, the particular division, the reason for benefits by payrolls and other minor breakdowns.

In other words, we are able to sort the cards in nearly any manner, depending upon the desired study we have in mind. By use of the tabulating machine in our Accounting Department we are able to list this information for study purposes. Along with this sickness and disability card we have put into use a summary card which uses the total figures of the various breakdowns in order to give us a faster compilation of the major studies.

### Seniority Raises Its Head

Most recently we put into use a card for seniority purposes. This involves roughly 1,500 employees, which necessitates considerable work in keeping the seniority list current. All supervised employees not engaged in office work are on seniority.

By use of the IBM card we are able to keep these current at all times, and for publication purposes all that is necessary is a sort of the cards and a run through the tabulating machine. From this listing we are able to publish the seniority list in a matter of about two weeks, where in previous years it has taken approximately three months. Here again we have saved time, but the chief advantage is the accuracy with which the work is completed.

We are at present preparing cards for the purpose of keeping records of our employees who are of draft age or who are affiliated with a military reserve organization. We feel that this information is vital to national defense and as such should be kept available for such use as may be necessary. While the group involved is a small percentage of our total employees, we feel that the time saving element is a vital factor in the keeping of these records.

### System Has Proved Worth

We have used the personnel accounting system now for almost a year, and find that it is highly satisfactory from a personnel standpoint. We feel it has done the following toward improving our personnel administration:

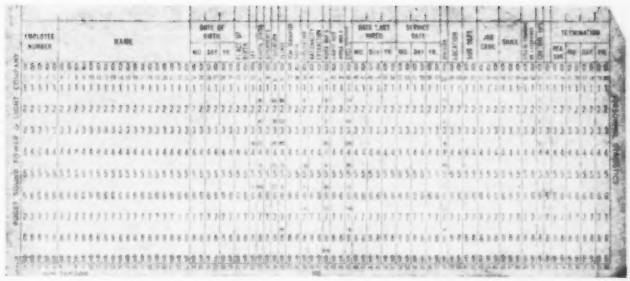
**1.** Given us accurate information in a minimum time.

**2.** Enabled us to supply our executives and our various divisions and departments with information aimed at improving the utilization of personnel and personnel functions, eliminating the necessity for going through volumes of records in arriving at a simple solution.

**3.** It has given us the opportunity to analyse and make studies which previously were not possible due to the time and available labor involved.

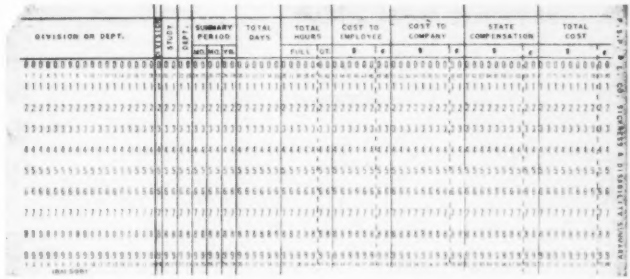
**4.** It has saved us a considerable number of man hours in performing the normal functions of our office.

In looking at the past year in which we have gradually increased our operation of personnel accounting, we feel that it is an important part of a well administered personnel department and also that as time progresses we will put it to greater use, which in the end will aid in our over-all planning for improved utilization of personnel.



**PERSONNEL STATISTICS CARD** contains employee's background, education, training, armed forces service, present location, personal and job classification information

**SICKNESS AND DISABILITY REPORT** provides complete information, including cost to employee and company, for allowance by company for regular employees who are off ill



**SICKNESS AND DISABILITY SUMMARY** uses total figures of various breakdowns to provide faster compilation of the major studies for quarterly reports

**SENIORITY RECORD** enables company to publish seniority list of about 1,500 supervised, non office employees in about two weeks—a procedure which previously required 3 months

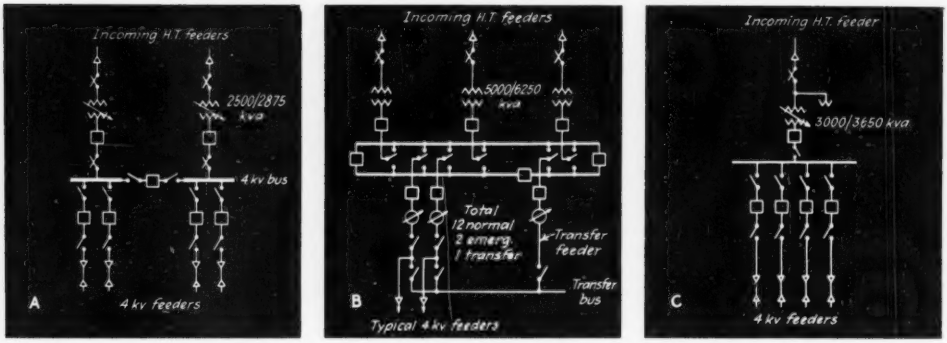



**FIG 1—COMPARATIVE BUS SCHEMES** for (A) small radial station, (B) large radial station, and (C) network station

# Metropolitan Primary Network Costs 60-80% of Radial 4 Kv

**Washington system finds primary network also more flexible in adaptability to load growth as well as giving superior operating performance**

W. J. LANK
Chief Electrical Engineer
Potomac Electric Power Co

EXPERIENCE with the primary network system in Washington has shown it to be economical in first cost and more flexible in its adaptability to load growth than a radial system and, in addition, has demonstrated its superior performance under operating conditions.

On the basis of the designs discussed and present day estimates (itemized in Tables I, II and III) the large radial station and system would cost $83.30 per kva, the four-radial stations—$75.20 per kva or 90%, the primary network—$56.60 per kva or 68% of the large radial station and system. Of course, in any system each area has different characteristics, some of which might favor one system over the other, such as, load density or primary supply feeders being at one location and not at the other.

However, it has been our experience for all types of areas and conditions that the primary network will cost from 60% to 80% of the cost of a comparable radial system. This does not mean that an existing radial system should be "abandoned" or "scrapped" since it would then cost more to substitute a new system. Whenever extensive addition to or rebuilding of an existing station or a large conversion from overhead to underground is necessary, a careful study of conversion of at least part of the load to primary network, by addition of a small station at a favorable location, may show this to be a more economical procedure.

In certain cases where existing conditions in a large radial station were particularly unfavorable, we have moved one transformer to a new location and networked it with the remainder of the old station. The resulting saving in underground construction and feeder regulators justified new site and station costs.

### Fewer Faults

Experience has also shown that permanent faults per mile year on the network average 42% of the value for radial feeders. Operation is more flexible since wires down on a main tie need only be cut clear to restore service to all customers. Also, there is less congestion on pole lines and fewer cables per conduit line. A cost comparison* showed a saving of about 33% for a three unit primary network compared with a new large

* See "Design and Experience with the 4-kv Primary Network in the Washington Area" by the author at the AIEE 1949 Summer General Meeting. It gives comparative performance data in detail.

radial station for one particular case.

An economic analysis of a theoretical area will be attempted, taking into consideration present cost levels. The three systems considered are:—

1. A large station supplying radial feeders.
2. A primary network system of four small stations.
3. Four small stations supplying radial feeders.

The economic use of a combination station supplying a primary network and radial load is discussed but costs are not developed because it is a special case applicable only to certain conditions.

### Three Mile Square

To make a comparison of cost of the three principal types of systems, we have assumed a nine square mile area of uniform density per city block with a total area load of 16,000 kva. In the actual system, the load density would not be uniform but would tend to be more concentrated along the business street or arterial highway—say "Q" Street. Also, we have assumed that the supply feeders enter the area from 33rd and "Q" Streets in all cases.

The layout of each system is based on what would be considered "good practice" for such an area and are as nearly comparable as possible for security of service, voltage regulation and emergency back-up protection for each feeder. Also, in this layout an attempt was made to cover the area with feeders such that generally no more than one crossarm per pole would be required except for "buck" arms and arms required for transformers, disconnects or other local equipment. Primary mains have been added to each system for equal distribution transformer spacing.

### Feeder Loading

In the large radial station or four-station radial system, the 12 normal feeders average about 1,330 kva of normal load and are backed up by an emergency feeder at each of the respective feeding points. Because of varying load characteristics of one feeder with respect to another, the average loading of all feeders will be somewhat less than the individual feeder peak. The network feeders would carry 800 kva from each end during normal loading, or 1,600 kva from one station automatically, under the emergency conditions of one end open or for the loss of the other station. This average loading of the radial and network feeder represents the amount of load per feeder we have obtained on each of these systems. Estimates are based upon present day costs in Washington. These may vary considerably with other locations due to zoning and building code requirements, tree conditions, and difficulties presented by local rights-of-way.

As may be noted from the design layout, the number of feeders to and from the large radial station require

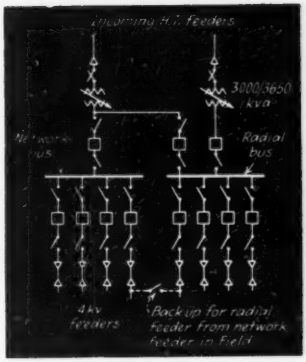



**FIG 2—BUS PATTERN** for combination radial-network station with emergency throw over so that network serves as dual reserve

a considerable amount of underground construction to avoid pole line congestion. Also, since the feeders are of various lengths, individual feeder regulation is required.

In the network system, underground construction is used in the vicinity of each station and up to a point where the feeders can be dispersed. The voltage of each network bus is regulated by a tap changing transformer. In the four-station radial plan, it is necessary to have two supply feeders to each station. In this case, underground construction is the same as in the network stations but it is assumed that one of the supply feeders to each station would be "open wire" and the other "aerial

**TABLE I—Estimated Cost Large Radial Station and System**

| | |
|---|---|
| **Power Supply** | |
| 8,000′—4-w Conduit at 13.00 | $104,000 |
| 24,000′—500-Mcm Cable at 5.50 | 132,000 |
| Supply Cost | $236,000 |
| **Substation** | |
| 3—5/6.25 Mva Transformers at 22,000 | $66,000 |
| 3—Bus Ties at 10,000 | 30,000 |
| 3—Transformer Secondaries at 15,000 | 45,000 |
| 15—Feeder Positions at 10,000 | 150,000 |
| 45—Regulators at 2,500 | 113,000 |
| Building and Land (100,000 cubic feet) | 125,000 |
| Substation Cost | $529,000 |
| **Distribution Feeders** | |
| 2,000′—8-w Conduit at 14.00 | $28,000 |
| 8,000′—6-w Conduit at 12.00 | 96,000 |
| 50,000′—4/0, 3/c at 3.25 | 163,000 |
| Pole Line | 180,000 |
| 270,000′—1/0 Wire at .20 | 54,000 |
| 360,000′—#2 Wire at .13 | 47,000 |
| (Does not include transformer and secondary) | $568,000 |
| Total Large Radial Station and System | $1,333,000 |
| Nine (9) Square Miles—Total Load 16,000 kva per kva | $83.30 |

**TABLE II—Estimated Cost Four Small Radial Stations and System**

| | |
|---|---|
| **Primary Supply** | |
| 5,000′—4-w Conduit at 13.00 | $65,000 |
| 18,000′—350-Mcm Cable at 5.00 | 90,000 |
| Pole Line | 22,000 |
| 96,000′—2/0 Wire at .25 | 24,000 |
| 30,000′—4/0, 3/c aerial cable at 5.00 | 150,000 |
| Supply Feeders | $351,000 |
| **Substation** | |
| 8—2500/2875-kva transformers at 25,000 | $200,000 |
| 8—Transformer Positions at 11,500 | 92,000 |
| 14—Feeder Positions at 7,500 | 105,000 |
| 4—Bus Ties at 7,500 | 30,000 |
| 4—Building and Land at 35,000 | 140,000 |
| Substation | $567,000 |
| **Distribution** | |
| 4,500′—1-w Conduit at 3.00 | $14,000 |
| 2,800′—4/0, 3/c, 4-kv Cable at 3.25 | 10,000 |
| 2,000′—4/0, 3/c, 13-kv Cable at 3.60 | 7,000 |
| Pole Line | 165,000 |
| 246,000′—1/0 Wire at .20 | 49,000 |
| 296,000′—#2 Mains at .13 | 39,000 |
| Distribution | $284,000 |
| Total Small Radial Stations and System | $1,202,000 |
| 16,000 kva per kva | $75.20 |

**TABLE III—Estimated Cost Four Primary Network Stations and System**

| | |
|---|---|
| **Primary Supply** | |
| 5,000′—4-w Conduit at 13.00 | $65,000 |
| 18,000′—350-Mcm Cable at 5.00 | 90,000 |
| Pole Line | 22,000 |
| 96,000′—2/0 Wire at .25 | 24,000 |
| Primary Supply | $201,000 |
| **Substation** | |
| 4—3000/3650 kva at 27,000 | $108,000 |
| 4—Transformer Switching at 11,500 | 46,000 |
| 20—4-kv Feeder Positions at 7,500 | 150,000 |
| 4—Building and Land at 25,000 | 100,000 |
| Substation Costs | $404,000 |
| **Distribution** | |
| 5,000′—1-w Conduit at 3.00 | $15,000 |
| 4,000′—4/0, 3/c, 4 kv Cable at 3.25 | 13,000 |
| 1,000′—350-Mcm Cable at 5.00 | 5,000 |
| Pole Line | 165,000 |
| 384,000′—1/0 Wire at .20 | 77,000 |
| 200,000′—#2 Mains at .13 | 26,000 |
| Distribution System | $301,000 |
| Total Primary Network System | $906,000 |
| Nine (9) Square Miles—Total Load 16,000 kva per kva | $56.60 |

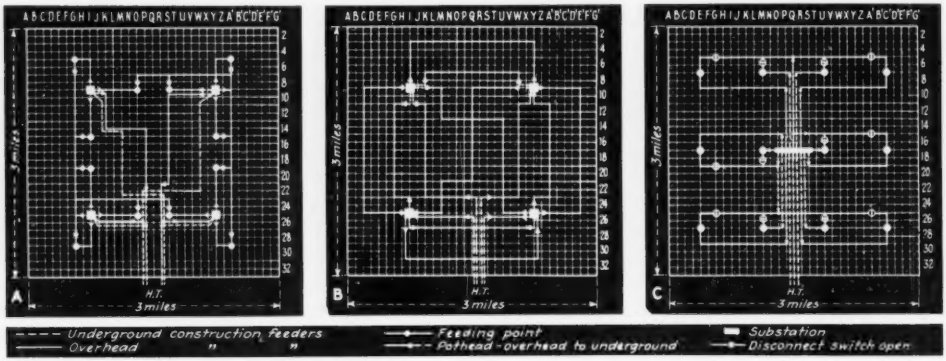

A B C D E F G H I J K L M N O P Q R S T U V W X Y Z A' B' C' D' E' F' G'
3 miles
H.T.
3 miles
A
B
C
Underground construction, feeders
Overhead " "
Feeding point
Pothead - overhead to underground
Substation
Disconnect switch open

**FIG. 3—SCHEME FOR FEEDING** 3-mile-square area (A) by small station and radial system, (B) network system with four small stations (C) radial system with one large substation. Supply feeders enter from 33rd and "Q" streets, "Q" being the main business street.

cable" to insure reliability of supply to each station similar to the large radial station or the primary network. Bus regulation, by means of tap changing transformers, is used as in the case of the network station.

#### Combination Radial-Network Stations

In some cases, where there is a heavily concentrated load surrounded by an area of lighter load, we have found that a two-unit radial station can be advantageously changed to a combination network and radial station. A wiring diagram for such a station is shown in Fig 2. In the event of failure of the primary feeder or transformer supplying the network bus, the network load is carried by other stations. Upon failure to supply to the radial bus, the transformer normally supplying the network bus is automatically disconnected from the network and closed in on the radial bus. In event of failure of the primary feeder or transformer supplying the network bus or the transfer of this transformer to the radial bus, service continuity is maintained from the network feeders within the permissable emergency voltage drop of this system.

In this case the remaining transformer in the two-unit station does not have sufficient capacity to carry the combination radial and network load, hence the transfer of capacity from the network system to the radial system. In this manner, the reserve capacity inherent in the network system serves the dual purpose of reserve for its own system, as well as the radial or concentrated load area. No estimate of cost is made for this system, since it is less costly than the straight network only in special cases as outlined.

In industrial or rural areas, where the outdoor type of station may be used, considerable savings can be made in the case of the network station by omitting the building and the substitution of the reclosing fuses for the feeder oil circuit breakers. As compared with breakers, these fuses have certain disadvantages. In some cases, all three fuses on a phase will be blown by a temporary fault, such as a tree limb, which lasts from two to twenty seconds, whereas a circuit breaker set for a time delay of greater than twenty seconds to the last reclosure will reclose successfully. Due to a faulty mechanism, the succeeding fuses will sometimes fail to close in after the first fuse blows.

Either of the two mentioned cases would preclude the use of the reclosing fuse for reliable radial service but are not serious in the case of the network system since service is maintained from the opposite end and there is little chance of the same trouble at both ends. It should be noted that while this saving can be made in one third of the network stations on the actual system, the cost comparison is based on all indoor type stations which utilize feeder circuit breakers.

In making an economic comparison of one system versus the other, all data is usually based on existing conditions with estimates of future conditions, such as, the place where load is expected to grow. If the study shows that initially a large radial station is the most economical solution, commitments for land and building, and some equipment, are made for the site estimated to be the future load center. As a result, the initial investment is considerable, and, if the load grows at a different location and at a different rate, there is not much that can be done except to continue expansion at the chosen location even though it may be uneconomical.

#### Indirect Economic Benefits

On the other hand, if small network stations are used, these can be located one at a time when and where the load actually develops. Thus, in practice, the network investment is directly related to yearly load growth and is flexible enough to permit building of stations when and where actually required. In addition, in event the character of a neighborhood should change, say, from industry to park land, so that a station would no longer be required at this location, there would be minimum loss or write-off in relocating the small station. Thus, a comparison of initial cost cannot show the intangible benefits of flexibility of the one system over the other.

**Accuracy of Type FR-1 Recloser Assures Best Continuity of Service!**

This rugged mechanical timer masterminds the General Electric FR-1 Automatic Recloser. Operating in air, its time-current characteristics remain exactly as published regardless of temperature, or viscosity changes of oil. You are assured of positive coordination — with breakers, reclosers in series, and with fuses.

**Don't Lose Minutes of Protection While a Recloser Resets!**

The FR-1 resets in a matter of seconds — instead of minutes — avoiding unnecessary fuse blowing and recloser lockouts from rapidly recurring faults. It holds service trips to a minimum during lightning and windstorms.

**Picking Up the Load Is Easy!**

With conventional operating function, manual reclosure is on time-delay. Furthermore, only G.E. includes the alternate "hold-closed" function — inrush currents can't lockout the recloser because it holds closed until these currents have subsided, then automatically resets for normal operation. This exclusive function also permits the use of more sectionalizing points and enables a saving in system investment.

**Interrupting Ratings Are Realistic at Full Voltage!**

The FR-1 performs smoothly at voltages from 2400 to 15,000. It is capable of clearing its maximum interrupting rating even at full voltage — your assurance of greater reliability.

**No Problem with Load Growth!**

No need to worry about load growth damaging the recloser. The FR-1 is self-protecting on overloads — withstands continuous current up to its minimum pickup rating — a feature which gives you time to plan system changes.

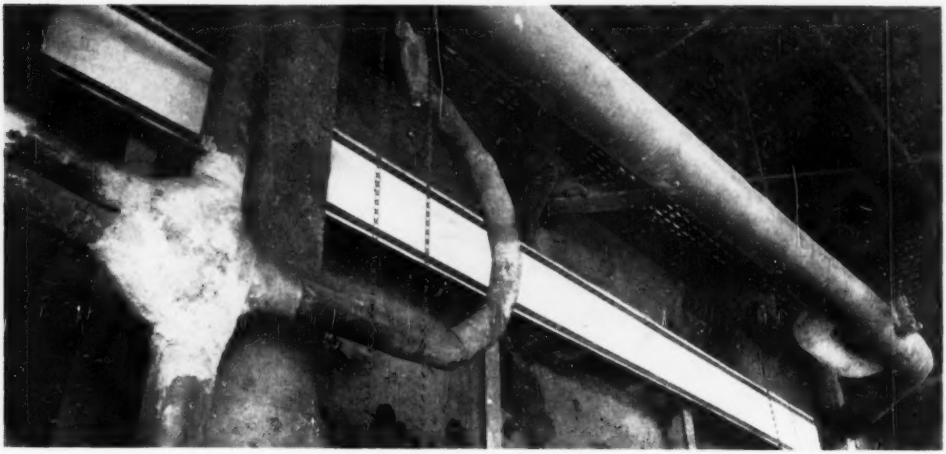
**No Other Recloser** combines these essential features. In addition the FR-1 gives you: choice of two operating functions — oil-blast interrupter — relay control of interrupter circuit — bushings interchangeable with those of modern G-E transformer — Thyrite protection for coils — conversion of ratings in service.

For a full story on this recloser including coordination data, write for bulletin GEA-1934. Address your nearest G-E Apparatus Sales Office or *Apparatus Department, General Electric Company, Schenectady 5, N. Y.*

GENERAL ELECTRIC

# HOW TO DESIGN • CONSTRUCT OPERATE • MAINTAIN

## New Sealing Material for Boiler Wall Corner Joints



**NEW SEALING** material used on Dietrich wall of a Philadelphia Electric Co boiler. The fabric is bolted in place through strap iron

A NEW SILICONE rubber-covered fiberglas material has been used by the Philadelphia Electric Company for sealing the corner joints of a wall in two of their boilers.

The installation, made at Richmond Station, is still in the experimental stage, but has been in service sufficiently long to indicate that substantial operating economy may result from using this sealing material.

The new material, known as Cohrlastic is manufactured by the Connecticut Hard Rubber Co, New Haven. It has an overall thickness of $\frac{3}{32}$ in., is resistant to high temperatures, not affected by corrosion, and is light and flexible. It is easy to install and repair, and it imposes no strain on other members.

Experience so far indicates that it overcomes many of the disadvantages of stainless steel bellows, and is much superior to other fabric seals tested for this application which could not withstand temperatures and corrosion conditions present.

The installation was made on two pulverized coal-fired boilers, each with an output of 600,000 lb of steam per hr. Steam conditions are 425 lb psi and 850 F at super-heater outlet.

The corners of the boiler were sealed from top to bottom with the material which was cut to an 18 in. width. Attachment was made by laying 2 in. strap iron over the fabric and bolting through. No gasketing was needed since the material is compressible and resilient and acts as its own seal.

The temperature in the corners was in the neighborhood of 300 F, which was safely withstood by the fabric. Air leakage along the corners was reduced to negligible proportions, with a resultant increase in boiler efficiency.

The material was also installed along an expansion joint in the tile wall, attachment again being made by bolting through strap iron, as was done in the corner seal. Here, the fabric was drawn in as the boiler was placed in operation.

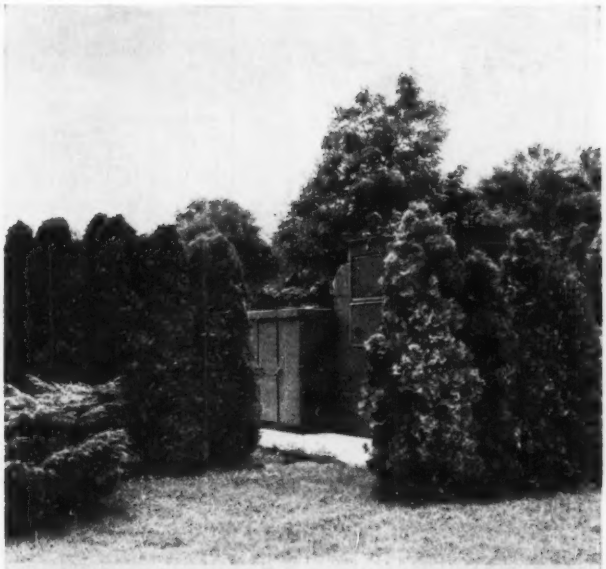
Should the fabric be damaged or badly abraded, it may be readily repaired in service by a simple cementing job. Outage of the boiler may not be required.

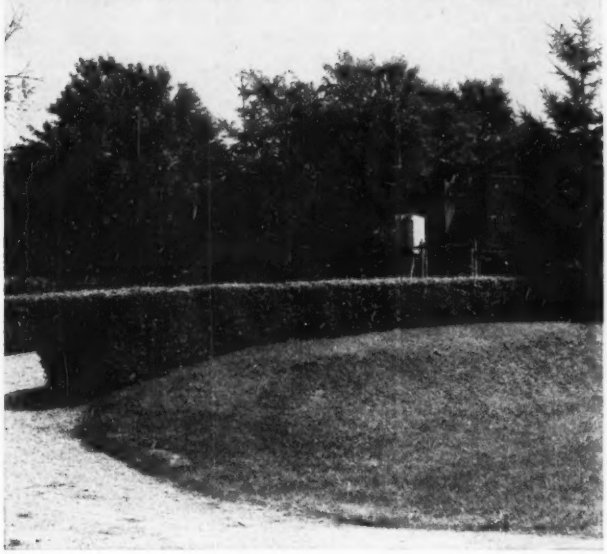
Philadelphia Electric is pleased with this new method of sealing boiler expansion joints.

## Magnesium Anodes Mitigate Cable Sheath Corrosion

L. F. GREVE
Corrosion Engineer
Commonwealth Edison Co
Chicago, Ill.

TO MITIGATE cable sheath corrosion a duct survey was made with a special kit consisting of resistors, and batteries, used with voltmeters and a lead sheath electrode pushed into a vacant duct (see EW, September 24, 1949, p 102).





THE PROBLEM OF
SUBSTATION APPEARANCE
IN RESIDENTIAL AREAS IS
EASILY OVERCOME WHEN YOU
INSTALL GENERAL ELECTRIC
UNIT SUBSTATIONS . . . .
THEIR INTEGRATED DESIGN
MAKES THEM EASY TO LANDSCAPE
AND THUS OVERCOME
APPEARANCE OBJECTIONS.
ASK YOUR G-E REPRESENTATIVE
FOR BROCHURE GEA-5155
THAT SHOWS HOW OTHER
UTILITIES TOOK ADVANTAGE OF
G-E ENGINEERING AND SERVICE
(TWO EXAMPLES AT LEFT),
OR WRITE TO . . . .
APPARATUS DEPARTMENT
GENERAL ELECTRIC COMPANY
SCHENECTADY 5, NEW YORK.

GENERAL ELECTRIC

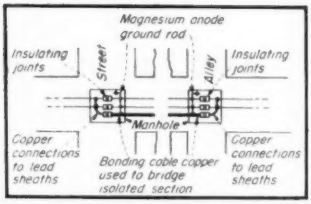



**FIG 1—INSULATING JOINTS** and magnesium anode ground rods were installed in each manhole at ends of isolated section. A copper bonding conductor was used to bridge the section as indicated on bonding diagram

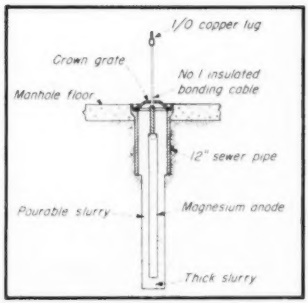



**FIG 2—INSTALLATION** of magnesium anode uses a 1 0 copper lug connected to the bonding cable above the water line with additional lugs for tests; a 12-in. sewer pipe at manhole floor level; a 4-in. diam x 5 ft long magnesium anode ground rod; a thick slurry (consisting of three parts of bentonite, one part ground gypsum, and water) at the base of the anode; and a pourable slurry made of the same materials as the thick slurry is filled in around sides of anode

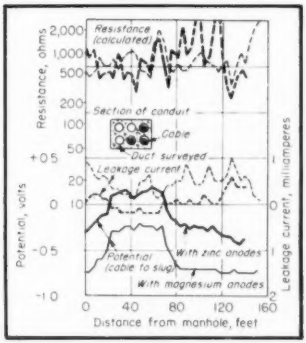



**FIG 3—COMPARATIVE** results on sheath potential, leakage current, and resistance at one location when magnesium anodes (data in heavy lines) were used to replace zinc anodes aged 12 years (light lines)

In the investigation, an excavation was made and the conduit exposed where tests indicated the highest positive potential existed. The conduit was about 7 ft below the surface of the street and was located in clay soil. The fill consisted of cinders. Readings in the excavation showed the sheaths averaged 0.5 v negative to the cinders and 0.2 v positive to the clay. This difference of potential between the clay and cinder fill indicated the positive condition of the sheath was due to a concentration cell.

Tests were made to determine the possibility of overcoming the concentration cell by increasing the electrical drainage of the cable sheaths. Results indicated that it would be necessary to drain an additional 35 amp from the sheaths at one location to maintain a slightly negative to earth throughout the length of the conduit. From an economical standpoint, this method of mitigating the trouble was not practical.

From near the manhole to 80 ft into the duct the cable sheaths were found to be as much as 0.5 v positive to earth. This positive condition was eliminated by (1) isolating the cable sheaths and the lengths of conduit from the system by means of insulating sleeves, (2) connecting the isolated section to zinc ground rods in each of two manholes, and (3) bonding the cable sheath system around the isolated secton.

After 10 years of service with the zinc rods the cable sheaths were found to be as much as 0.2 v positive to earth again, indicating that the zinc rods were deteriorating. The zinc rods were replaced with magnesium anodes. Connections and the method of installing the latter are shown in Fig 1 and 2.

Complete results of the duct survey made before and after the magnesium anodes were installed are shown in Fig 3. This graph indicates the sheath potentials, the leakage current and the resistance at a location which has been under observation periodically for more than 12 years.

# Tool for "Unlocking" Cotter Keys

**H. P. SLEEMAN**
Electrical Engineer
The R. Thomas & Sons Company

THE POPULARITY of ball and socket suspension insulators is due in part to the ease with which they may be connected and disconnected, in the field, having no loose parts to handle, fall or get lost. It is general practice to ship insulators in strings of six, from which strings of any number of units are usually made up in the field prior to erection. The importance of insuring positive locking of the coupling need not be stressed, since accidental uncoupling during erection or in later service may have serious consequences.

It was formerly customary to bend only one leg of the locking key, so that to "unlock" the key it was only necessary to place an ordinary screw driver against the end of the unbent leg and give it a mild bump. It is now standard practice to bend both legs of the locking key, to more effectively block the throat opening in the locked position and to more effectively prevent complete removal of the key under a sudden "yank" during hot line work. Locking both legs will also insure non-interference with hookup in the unlocked position, prevent sideways displacement, and danger of flattening of the key from pressure of the ball pin in the locked position.

It would appear that the ordinary screw driver is not the best tool that could be devised to "unlock" these keys, and that excessive force applied may cause sufficient distortion to the locking bulge as to destroy the locking effectiveness of the key.

### Unlocking the Key

Referring to Fig 1, to unlock the key it is necessary to force the bulge B through the constricted opening C at the rear of the socket. Dimension B is a minimum when dimension A is zero, or when the legs are touching. The keys are designed so that this minimum dimension of the bulge B will pass through C under a mild bump, by reason of the spring action of the key; and the

# WE STOPPED THEIR BREATHING TO PROLONG THEIR LIFE!

On large tanks, Nitrile rubber gasket of circular cross-section is compressed as shown. Ring welded to tank keeps gasket in place—prevents too much compression.
On small tanks, Nitrile rubber gasket of square cross-section is compressed between rim of cover and deep-rolled flange on tank. Shown uncompressed.

**In G-E Spirakore® transformers,** Nitrile rubber gaskets—unharmed by oil, age, or operating temperatures—effectively seal out atmospheric air, moisture, and other contamination—thereby greatly prolonging the life of the insulating oil and consequently the units themselves. By redesigning the tanks, covers, handholes, and gaskets, we've made this sealing possible *and improved accessibility!*

Some years back, we sealed our power transformers completely. Now we've done it with all liquid-immersed, distribution transformers. We've stopped their breathing, too. We've made sealed tank construction available in all General Electric Spirakore transformers—from the smallest to the largest.

### Other Improvements

Yet sealed-tank construction is only one of the improvements you get with General Electric distribution transformers. You get Spirakore design—for great savings in size and weight. You get improved impulse strength. You even get a new and better baked synthetic-resin paint, which reduces maintenance costs.

**Today**—as ten years ago when lighter, smaller Spirakore transformers first made history—Spirakore still leads the field. It's the finest distribution transformer we have ever made, the finest you can buy. Ask for Bulletins GEA-4885 and GEA-4521. *Apparatus Dept., General Electric Company, Schenectady 5, N. Y.*

GE Spirakore Transformers

GENERAL ELECTRIC

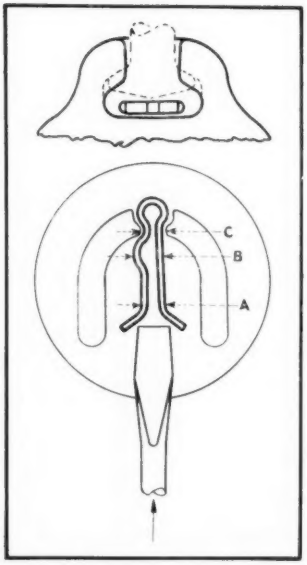



**FIG 1—AN ORDINARY** screwdriver is not satisfactory for "unlocking" keys in ball and socket suspension insulator couplings. Excessive force applied to force bulge B through C may distort bulge making key ineffective

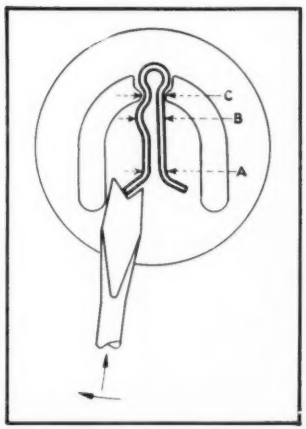



**FIG 2—SCREWDRIVER** with a V-slot ground in its end is an effective tool for removing the pins without distorting them

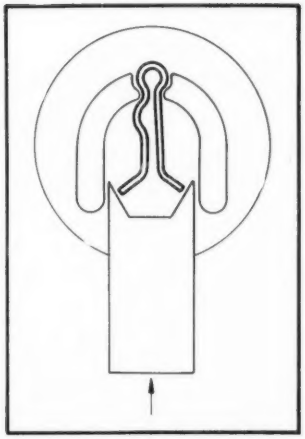


**FIG 3—THIS** relatively simple tool would be a valuable addition to a "ground" man's tool kit; eccentricity is eliminated

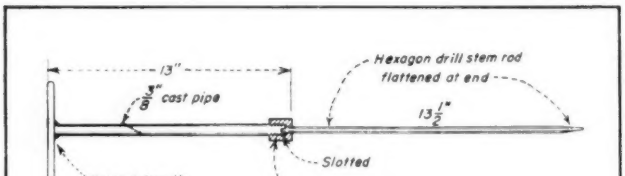
action can be performed many times with no distortion, or loss of positive locking action. An ordinary screwdriver jammed against the spread legs has a tendency to increase the dimension of the bulge B, and if sufficient pressure is used to force this enlarged dimension of the bulge B through the opening C, there is a definite possibility, that the back end of the key may be permanently distorted. Positive subsequent locking action by virtue of its spring action may be destroyed, with the consequent danger of it becoming accidentally uncoupled.

It would appear that a screwdriver with a V slot ground in its end as shown in Fig 2 would be a more effective tool, or a relatively simple tool as shown in Fig 3 would be a valuable addition to a "ground" man's tool kit. It can be seen that pushing the tool results in a uniform pressure being applied to the pin.

# Handy Tool for Testing Poles

**E. B. JOHNSTON**
**Materials Analyst**
**Oklahoma Gas & Electric Co**
**Oklahoma City**

WORKING on the philosophy that the doctor's examination should not kill the patient, Oklahoma Gas & Electric Engineers have developed a small pole probing tool that eliminates damage to the pole when testing. One half consists of a ⅜-in. cast iron pipe 13 in. long with a 3-in. iron bar welded to the end at right angles to the pipe. This cross bar is the handle. The ⅜-in. pipe forms the large, or handle end when the probe is in use. When the probe is not in use, the probe end separates from the pipe section and is turned to slip into the pipe like a sword in a scabbard.




**TOOL** is made of ⅜ in. cast iron pipe 13 in. long, hexagon drill stem rod 13½ in. long, a nipple and the handle, a 3-in. iron bar welded to the end at right angles to the pipe

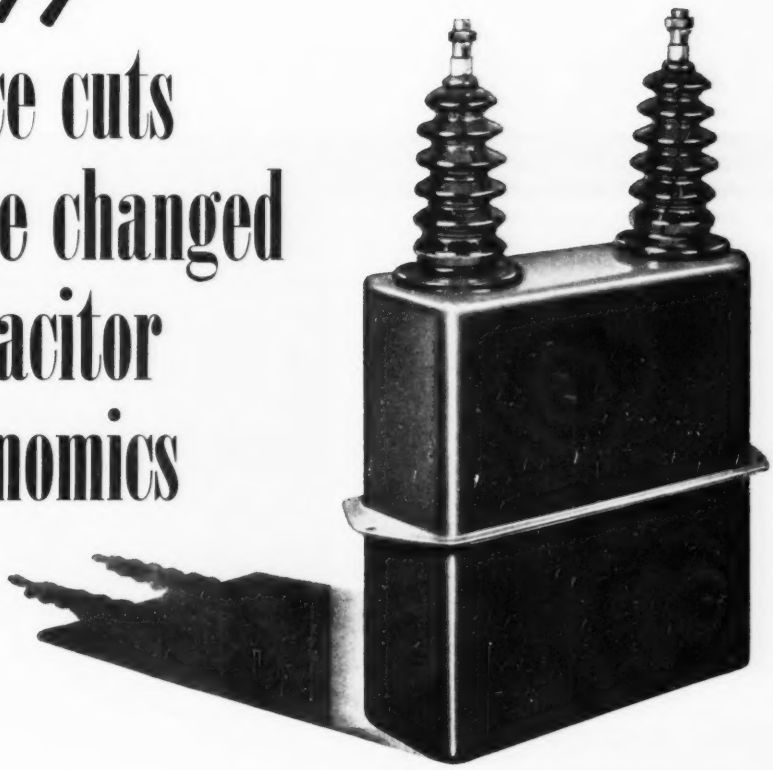
Hexagon drill stem rod forms the probe end of the tool. It is flattened and tapered but not too sharply.

Where the two sections join, the pipe is notched and threaded. A shoulder on the end of the probe section fits into the slot in the pipe and a nipple partially closed at one end, slips over the probe, screws onto the pipe holding the two parts firmly together. The shoulder on the probe fitting into the slot in the pipe prevents the probe from turning when the nipple is screwed over it firmly.

Overall length of the tool when assembled for work is 27½ in. When dismantled and the probe end is slipped into the pipe section, overall

(Continued on p. 128)

# 1949 price cuts have changed capacitor economics



## It will pay you to re-evaluate

The price of 25-kvar capacitor units has been cut 20 to 23% in less than a year! These reductions on 25-kvar units and on capacitor equipments mean that you can now supply your system kilovars at a lower cost than ever before in history.

These new low prices dictate a re-evaluation of capacitor economics. Proposed installations which were considered marginal less than a year ago are now economically justified. Additional installations, never before considered, may now be justified.

Your G-E sales representative will be glad to help you determine the up-to-date capacitor economics of your system. *Apparatus Dept., General Electric Company, Schenectady 5, N. Y.*

**G-E Pyranol® capacitors,** including the 25-kvar pole-mounted unit shown here, can be shipped from stock. Installation is simple and quick—they can be in service, releasing kilowatt capacity and improving voltage level, in a matter of weeks.

**A G-E capacitor** is one of the most reliable pieces of electrical equipment you can install. The bushings are of glass, welded to the drawn steel container for a permanent hermetic seal. The use of low-loss Kraft paper impregnated with Pyranol assures stable characteristics throughout a long operating life. In every respect, G-E capacitors are a proved product—proved through field experience measured not in years, but in decades.

GENERAL ELECTRIC

# Customer-Owned Service Poles—I

**Minimum requirements shown on sketches and outlined in notes have been approved by California Public Utilities Commission on the basis of drawings submitted by an electrical utility. Standards for both public and private utility—serving agencies will be approved on a similar basis as drawings are submitted. Pole construction and attachments for service drops and meters are outlined here. Reference notes, service drop clearances and meter connections will appear in Engineering Reference Sheet No. 49-41.**

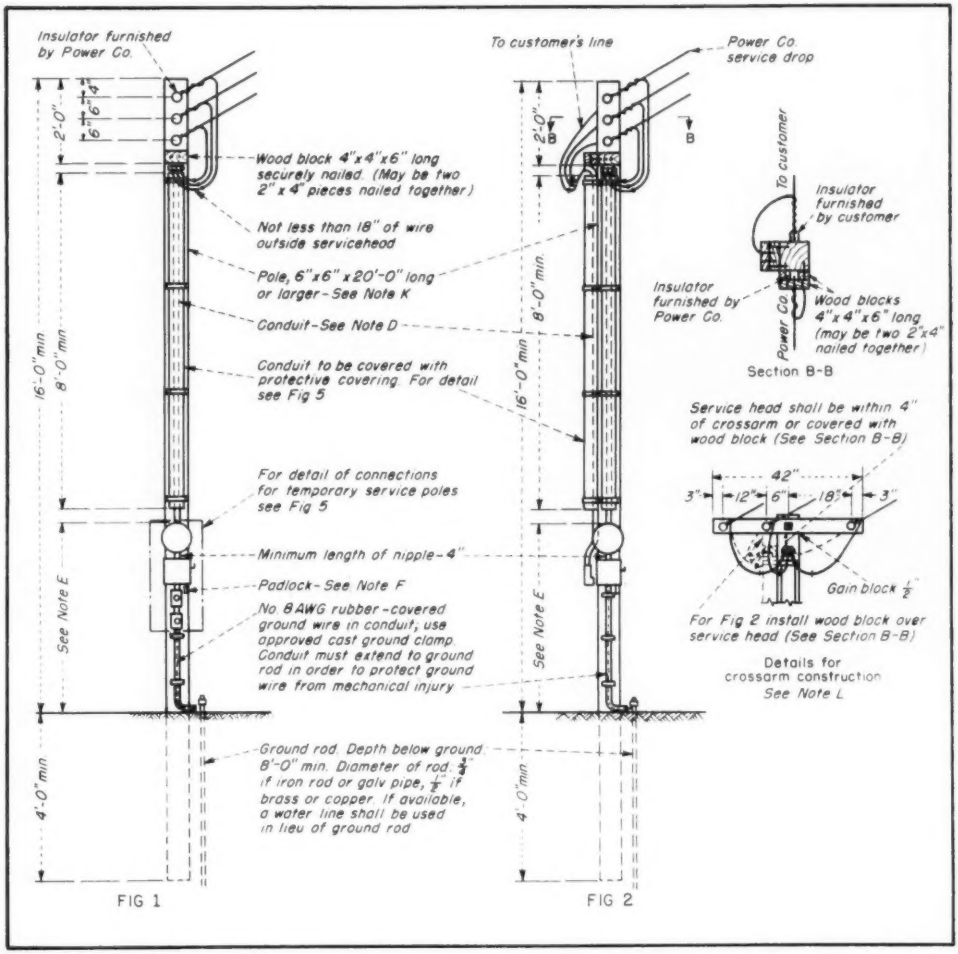

Insulator furnished by Power Co.
2'-0"
6"
6"
6"
Wood block 4"x4"x6" long securely nailed. (May be two 2" x 4" pieces nailed together)
Not less than 18" of wire outside servicehead
Pole, 6"x6" x 20'-0" long or larger - See Note K
Conduit - See Note D
Conduit to be covered with protective covering. For detail see Fig 5
For detail of connections for temporary service poles see Fig 5
Minimum length of nipple - 4"
Padlock - See Note F
No. 8 AWG rubber-covered ground wire in conduit; use approved cast ground clamp. Conduit must extend to ground rod in order to protect ground wire from mechanical injury
Ground rod. Depth below ground 8'-0" min. Diameter of rod, ¾" if iron rod or galv pipe, ½" if brass or copper. If available, a water line shall be used in lieu of ground rod
16'-0" min
8'-0" min
See Note E
4'-0" min
FIG 1
To customer's line
Power Co. service drop
2'-0"
B
B
8'-0" min
16'-0" min
See Note E
4'-0" min
FIG 2
To customer
Insulator furnished by customer
Insulator furnished by Power Co.
Wood blocks 4"x4"x6" long (may be two 2"x4" nailed together)
Power Co
Section B-B
Service head shall be within 4" of crossarm or covered with wood block (See Section B-B)
42"
3"
12"
6"
18"
3"
Gain block ½"
For Fig 2 install wood block over service head (See Section B-B)
Details for crossarm construction See Note L

**FIG 1—SERVICE POLE** to be used for temporary installation during building construction when portable electrical equipment is to be used. It is equally adaptable to permanent installations for supplying small lighting or power loads when the service entrance conductors may be brought in to the equipment by underground means

**FIG 2—SERVICE POLE** to be used either as a temporary or permanent installation where service conductors enter and leave the pole overhead. Minimum dimensions for customer-owned poles are shown

what's **New** in street lighting

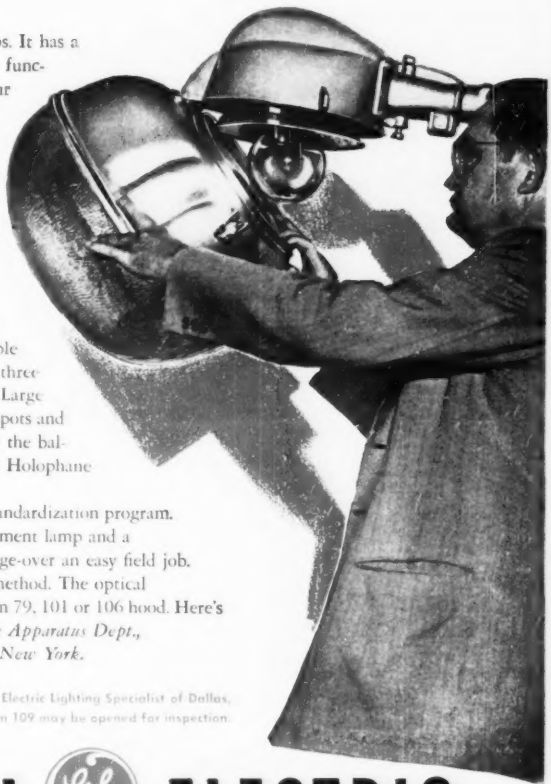
# For 15,000 Lumen Lamps here's the most effective Luminaire ever built

It's the new Form 109 using filament lamps. It has a distinctly modern appearance, with clean functional lines. By day it calls attention to your street lights. By night it increases safety on your streets.

And it brings a new effectiveness to street lighting. The long-sought rectangular roadway light pattern is now a reality with the Form 109. The secret lies in an exclusive G-E ovate reflector which starts the light in the right direction.

And it's safer because there is less glare than with any other luminaire of comparable lumen output. The Form 109 reduces glare three ways—(1) Deep-shielded light source, (2) Large low-intensity refractor which has no "hot" spots and (3) Extremely accurate control of light by the balanced operation of the ovate reflector and Holophane verti-lateral refractor.

And the Form 109 will fit in with your standardization program. It will burn any 7" or 9½" light-center filament lamp and a complete line of mercury lamps—with change-over an easy field job. It's available with any standard mounting method. The optical assembly can be adapted to any existing Form 79, 101 or 106 hood. Here's a luminaire you want to know about. Write *Apparatus Dept., General Electric Company, Schenectady 5, New York.*



Mr. G. C. Buchanan, General Electric Lighting Specialist of Dallas, Texas, shows how easily the Form 109 may be opened for inspection.

GENERAL ELECTRIC

452-88

# Occupational Accident Causes

**Classification of causes is made according to responsibility and to specific accidents. The arrangement is a revision expanded on the basis of 10 years' experience of the New England Electric System**

DESIGNATED RESPONSIBILITY for accident causes are: (S) Avoidable—Fault of Supervision; (W) Avoidable—Fault of Worker; (O) Avoidable—Fault of Other Worker; (X) Unavoidable—Beyond Our Control.

Classification of causes of accidents follows.

### Fault of Supervision

**S-1. *Lack of Proper Safety Equipment.*** Lack of Safety equipment which should be provided by the employer, viz.: goggles, barriers, flags, lanterns; rubber protective devices such as gloves, blankets, hoods; respiratory protective equipment, etc.

Defective safety equipment which reasonable test and inspection would reveal.

Does not apply to failure to use equipment which is furnished by employer. See W (or O)-22.

**S-2. *Lack of Proper Supervision.*** Accidents caused by lack of supervision where work is considered unusually hazardous. Laxity in matter of check-up of work methods. Lack of proper inspection and maintenance. Failure to follow-up reported injuries or to see that proper medical attention was secured.

Applicable to cases in which employee was not told how to do his job, how to protect himself and other employees, and was not informed as to the hazards of the job.

Applies to injuries where employee was physically or mentally unqualified to do the assigned job. Compare to X-41. Further applies to assignment of inexperienced men to strange work, unqualified men to hazardous work and assignment of men to work known to be unsafe.

**S-3. *Poor Housekeeping or Working Conditions.*** Accidents caused by materials improperly piled or stored; passageways not clear—defective stairways; dirty or greasy floors; tripping hazards. It further applies to permitting work in unnecessarily exposed place. Accidents due to lighting, and lack of ventilation.

**S-4. *Defective Construction*** Accidents caused by inadequate staging, supports, braces or guys; poorly designed construction.

**S-5. *Defective Equipment.*** Applicable where equipment is defective. Should be checked with S-2.

Accidents caused by defective tools, such as mushroomed chisels, splintered pikes, shovels, etc; loose hammer or axe heads, damaged ladders, worn or rotted ropes.

Defects in machinery or equipment which are known to exist but have not been condemned or repaired.

### Fault of Workers

**W (or O)-20. *Failure to Report Injury.*** Infection due to neglect of small cuts, scratches or injuries not properly treated.

This cause will also apply in cases where proper person was not notified promptly concerning injuries received.

This cause is regarded as a serious offense. See W (or O)-23.

**W (or O)-21. *Failure to Use Safe Attire.*** Accidents which result from an employee's own wearing apparel, such as loose or dangling clothing around revolving machinery; defective footwear, high-heeled shoes; sleeves rolled up while engaged in line work; insufficient clothing in cold weather.

**W (or O)-22. *Non-Use of Safety Equipment.*** Accidents caused by failure of employee to use proper or sufficient safety equipment furnished and available such as rubber gloves, goggles, respirators, barriers, flags, lanterns, insulating safeguards.

It will be noted that this cause bears a definite relation to W (or O)-23, but should be listed as the primary cause.

**W (or O)-23. *Improper Attitude.*** Accidents directly attributable to the attitude of the worker. Accidents caused by disregard of instructions, rules, disrespect of authority, adventurous or belligerent attitude, laziness, horseplay, etc.

**W (or O)-24. *Inattention or Carelessness.*** Cases where injuries are due to interest in something other than the job at hand, whether by abstraction or distraction; to carelessness due to lack of concentration.

**W (or O)-25. *Working Without Authority.*** Failing to Secure or Warn. Taking chances when not required to do so. Starting, moving, stopping, etc, without authority or giving warning.

Failure to block, lock or secure vehicles, rigging, switches, tools against movement, flow of electric current, gas, steam.

Failure to place warning signs, etc. Failure to warn other employes away from hazard.

**W (or O)-26. *Working at Unsafe Speeds.*** Accidents which result from undue haste, ie: running, jumping from trucks, platforms, etc, feeding work too rapidly, throwing material instead of passing, etc, driving too rapidly.

**W (or O)-27. *Unsafe Handling of Materials.*** Accidents which result from improper loading or unloading. All accidents which result from improperly stored materials or from improper handling of materials. Most over exertion (hernias, sprains, strains, etc) are included in this group.

Also applies to overcrowding, overloading, lifting or carrying too heavy an object.

It further applies to mixing or combining materials so that fire, explosion, etc. may result.

**W (or O)-28. *Unsafe Positions or Postures.*** Accidents sustained while the employee's body or part of his body is exposed to moving traffic, suspended loads or falling objects.

Also applies to standing too close to openings, riding in unsafe position, entering enclosure when unsafe due to temperature, gases, electric current, steam, etc.

It further applies to the improper or awkward position which an employee may assume in trying to do his work. May apply in some electrical cases.

**W (or O)-29. *Working on Moving or Dangerous Equipment.*** Applies to getting on or off moving equipment (vehicles, conveyors, elevators, etc), cleaning, oiling or adjusting moving machinery, working on electrically energized equipment or equipment containing volatile or dangerous substances.

**W (or O)-30. *Incorrect Work Method.*** Applies to using known unsafe equipment, the unsafe use of tools, using hands instead of hand tools, gripping objects insecurely, taking wrong hold on tools, using tools for other than the purpose for which they were intended, improper selection of method, tool or equipment for work at hand.

### Unavoidable—Beyond Our Control

**X-40. *Occupational Hazard.*** Accidents which may occur to any employee which cannot reasonably be guarded against.

(Dust particles entering eye on operations where goggles would not ordinarily be worn, come under this classification. Also most dog bites and poison ivy cases.)

**X-41. *Unknown Physical Deficiency.*** Accidents as a result of unknown organic trouble, such as heart failure, hernia, certain types of back strains.

This does not apply to cases in which supervision is aware of such deficiency. See S-2.

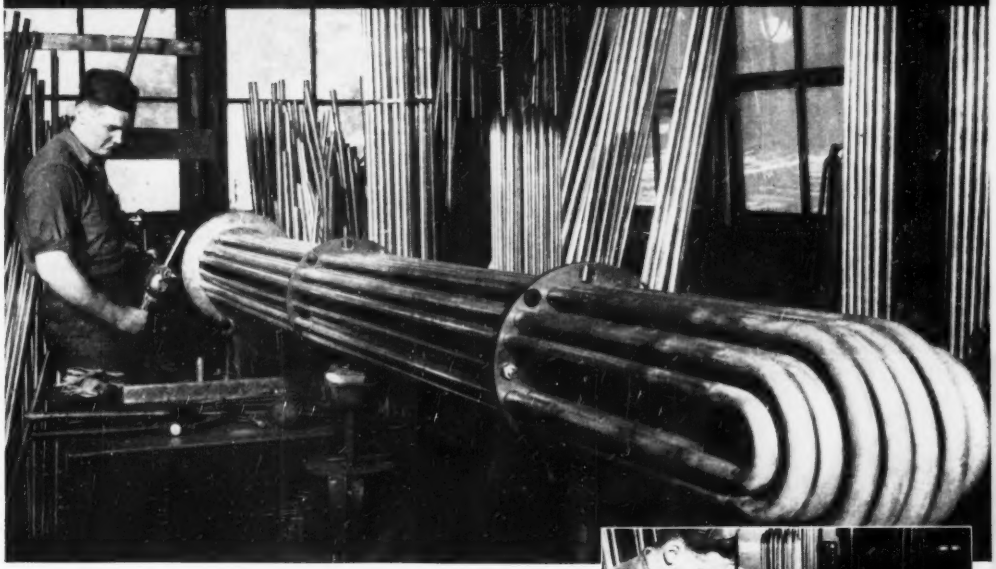
**X-42. *Unknown Material Deficiency.*** Accidents caused by failure of construction, equipment or material which cannot be foreseen or prevented by proper inspection or maintenance. Defects or flaws in purchased materials not easily recognized.

**X-43. *Fault of Non-Employee.*** Accidents caused by an act of omission or commission by a non-employee.

The "unavoidable" group called "X", should not be used as "catch-alls", particularly "X-40 Occupational Hazard." The fact still holds that only 2 or 3% of all accidents are unavoidable. Careful consideration should be given to all the new classifications before assigning any of the "X" group as a prime cause.

About the only clear-cut X-40 cases will continue to be some "foreign body in eye" ones where goggles would not ordinarily be worn; dog bites in which the employee has no responsibility and plant poisoning where reasonable care is taken to avoid exposure.

# REVERE COPPER TUBE of Special Bending Temper . . .



## . . . saves bending time, enables WESTERN BLOWER CO. to produce neater, more uniform tube bundles.

During the past nine years, Western Blower Co., of Seattle, Wash., has used hundreds of thousands of feet of $\frac{5}{8}$" and 1" O.D. Revere Seamless Copper Tube of special bending temper, with .049" wall.

They tell us that in working with this Revere Tube they are able to make large and small radius bends without the slightest difficulty and without heat treating, excepting the smallest 1" radius. This not only saves bending time but, enables them to turn out a better appearing tube bundle . . . an important item with Western Blower as many of their bundles are sold without tanks.

In addition to the above, this company has also used tens of thousands of feet of Revere Cupro-Nickel Tube in heaters where salt water was a problem. For this metal, which is one of the most corrosion-resistant of the copper nickel alloys, can withstand high operating temperatures and is not subject to dezincification.

Have you investigated the Revere metals to see how they might help you with your tube problems? Why not have Revere put the knowledge and experience, gained through years of helping others, to work for you? Call the nearest Revere office today.

**REVERE**

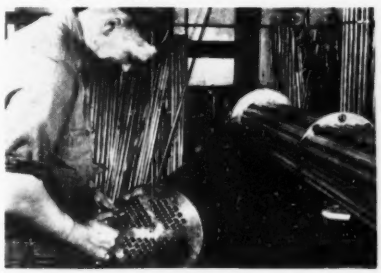
**COPPER AND BRASS INCORPORATED**

*Founded by Paul Revere in 1801*

230 Park Avenue, New York 17, New York

*Mills: Baltimore, Md.; Chicago, Ill.; Detroit, Mich.; Los Angeles and Riverside, Calif.; New Bedford, Mass.; Rome, N. Y.*
*Sales Offices in Principal Cities. Distributors Everywhere.*

*EXPANDING THE TUBE ENDS outside the header of one of the U-bend heat exchangers being turned out by the WESTERN BLOWER CO. Revere products have been used exclusively by this company for many years.*



*FLARING THE TUBE ENDS over the header. These coils, made of Revere Seamless Copper Tube, of Special Bending Temper, are used in tanks for domestic hot water, in side arm heaters, condensate coolers and converters.*

## HANDY TESTING TOOL

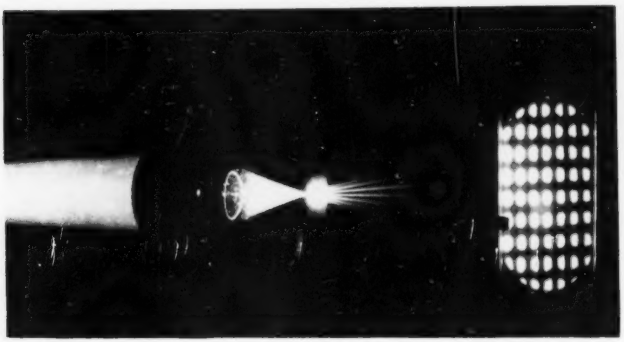
(*Continued from p. 122*)

length is only 14 in. and the tool can be carried in the brief case. Weight is only 14 oz.

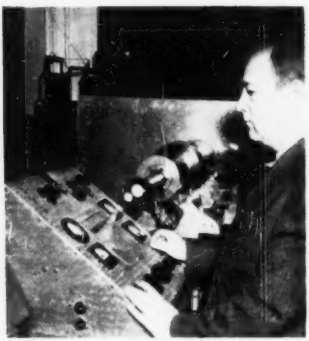
Extent of shell rot or ground line rot can be determined very easily with this tool. The point can be slipped into cracks to determine depth of checks or to determine the extent of any inner decay that exists without being injurious to the pole.

After first determining that there may be inner decay, as when the probe can be inserted to an unusual depth in a check, or a hollow sound results when the pole is struck with a hammer, exploration to determine the extent of inner decay is made. An effort is made to insert the probe to the sides at various angles, and ability to do this depends upon extent of decay. Usually it is relatively easy to push the point of the probe through the inner walls of the check which are in a state of semi-decay when hollow areas are beyond.

# New Method Aids Study of Electrostatic and Magnetic Fields



**A MOUNTED LENS** system converges light from a distant source to form a reduced image of the source at a point just to the left of the wire screen (center). A magnified shadow image of the wire screen is formed on the ground glass screen at the right. Use of this method permits exploring of complex electric and magnetic fields of extremely small dimensions



**DR. L. L. MARTON,** who developed the electron-optical shadow method, is shown at the control panel of the horizontal electron Microscope at National Bureau of Standards

A NEW electron-optical shadow technique has been developed which provides a valuable tool for the quantitative study of electrostatic and magnetic fields of extremely small dimensions. This development resulted from a series of electron-microscope experiments by Dr. L. L. Marton of the Electron Physics Laboratory at the National Bureau of Standards, Washington, D. C.

The new method makes use of an electron lens system to produce a shadow image of a fine wire mesh placed in the path of the electron beam. From the distortion in the shadow network caused by deflection of the electrons as they pass through the field under study, accurate values of field strength are computed. Thus it is possible to investigate quantitatively fields that have not been susceptible to other methods of investigation, for example, the fringe fields from the small domains of spontaneous magnetization in ferromagnetic materials. This method will also be found useful where a probe of size greater than the electron would disturb the field under study.

# Magnetic Clutch Uses Special Alloy Floating Plate

**B. S. BURY**
Representative
Autronic Developments Ltd
New York City

A HIGH PERMEABILITY floating plate provides excellent magnetic contact between the operating faces of newly designed electromagnetic clutch and brake units.

The magnetic clutch unit consists of a dish magnet and armature of selected steel, each with fully lubricated, highly polished, hardened working faces. Between these two faces is a slotted, and very thin, high permeability floating plate. The plate is in physical contact with the magnet and the armature and serves three main purposes:

**1.** As an essential part of the electro-magnetic circuit, it enables the flux lines to have the shortest possible distance of travel and to pass through a highly magnetic conducting medium for the completion of the magnetic circuit.

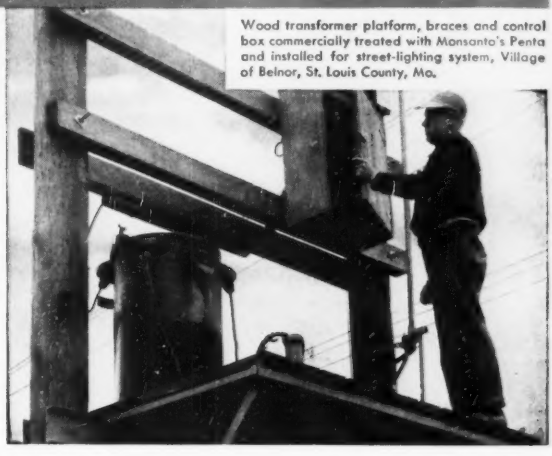
**2.** The creeping action of the plate as the clutch operates floods its surface with oil at every operation.

**3.** Being physically softer than the magnet and armature, the plate is an easy replacement part.

The magnetic circuit is the most efficient that can be devised, the magnetic lines of force having the

# this can't happen here

These rotten, unsafe wooden members were replaced with Monsanto Penta-treated material.



Wood transformer platform, braces and control box commercially treated with Monsanto's Penta and installed for street-lighting system, Village of Belnor, St. Louis County, Mo.

# PENTA

(Santophen 20)

## CHLOROPHENOL preservative

Treatment with Monsanto's Penta will add years to the service life of your poles, crossarms and structural wood. It provides long-lasting protection against decay, termites and other wood-destroying insects, yet leaves wood CLEAN and workable... Penta-treated material is dark or light-colored, depending upon the oil solvent used. In either case, it is still CLEAN and non-staining.

Monsanto's Penta penetrates thoroughly. Protection *stays* in the wood, resists leaching by moisture, remains effective under high humidity. Furthermore, Penta is a definite chemical entity — its characteristics are always constant, always laboratory-controlled.

Men who plan or maintain transmission lines and wood construction quickly recognize the advantages of Monsanto's Penta — described in the booklet, "PENTA ... The Best Protection for Poles and Crossarms." Send for your free copy today. MONSANTO CHEMICAL COMPANY, Desk G, Organic Chemicals Division, 1758 South Second St., St. Louis 4, Missouri.

MONSANTO
CHEMICALS — PLASTICS

*Santophen, Reg. U. S. Pat. Off.*

MONSANTO CHEMICAL COMPANY
Desk G, Organic Chemicals Division
1758 South Second Street, St. Louis 4, Missouri

Please send me a copy of "PENTA... The Best Protection for Poles and Crossarms."

Name _____ Title _____

Company _____

Address _____

City _____ State _____

SERVING INDUSTRY... WHICH SERVES MANKIND

# *The inside story about*

# MOLONEY *HiperCore* DISTRIBUTION TRANSFORMERS

The inside story about Moloney HiperCore Transformers is centered around the material used in the cores. By using highly efficient oriented silicon steel it is possible to work the cores at higher flux densities than formerly. With the *total* flux requirements remaining practically unchanged, working the oriented steel at higher densities than practical with ordinary silicon steel, results in smaller cross-sectional areas of cores with a consequent reduction in weights.

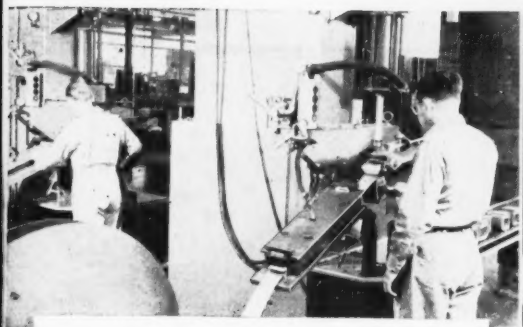
The smaller cores permit the use of smaller windings, smaller tanks and less oil. This results in lighter weight and smaller transformers which are easier to install and handle generally, and take up less space on the poles. Reductions in size and weight have been made without sacrifice in all-around performance. In fact, HiperCore Transformer operating characteristics are better . . . voltage regulation has been improved . . . greater short-time overloads can be carried.

Illustrated are a few of the operations involved in the manufacture of HiperCore Transformers indicating the careful attention given to every detail in order to assure unexcelled on-the-job performance.

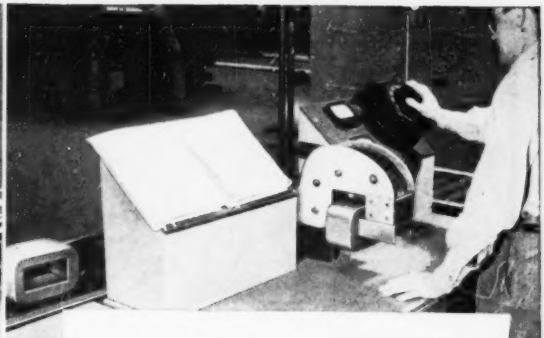
ME49-10

Testing voltage ratios at various tapchanger settings, to make certain that tap leads have been connected to proper studs, and that inter-coil connections are correct.

Placing core-and-coil assemblies in tanks after they have passed through oven which removes any moisture which may have been absorbed from the air, and also cures adhesive on core faces.



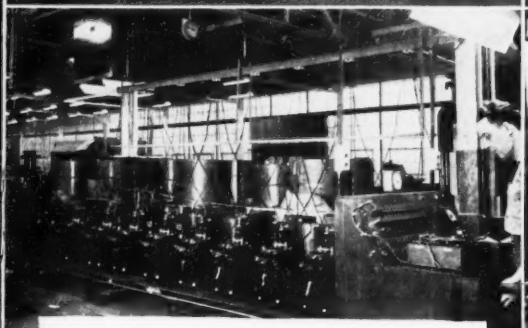
Cores are wound of oriented silicon steel. Winding machines are semi-automatic, stopping when proper thickness of winding is reached. End of core strip is spot welded.



Following winding of the cores, they are annealed in bell-type furnaces in a nitrogen atmosphere and are then given an initial test for losses as illustrated above.

Placing windings into position over U-shaped core pieces. Prior to this operation, cores have been impregnated, baked, cut, etched, and tested a second time.

Connecting tap leads from winding to tapchanger studs. On opposite side of assembly line, terminals are brazed to low voltage leads. Previous operations included applying adhesive to core faces, banding core pieces, and attaching frames.



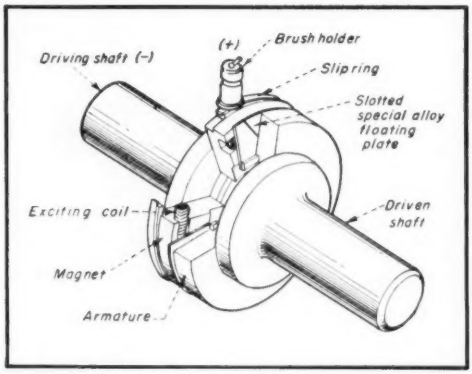
After bushings have been installed, the tanks filled with oil, and the transformers vacuum treated to remove any entrapped air from the oil or windings, final electrical tests are made.


**MOLONEY**

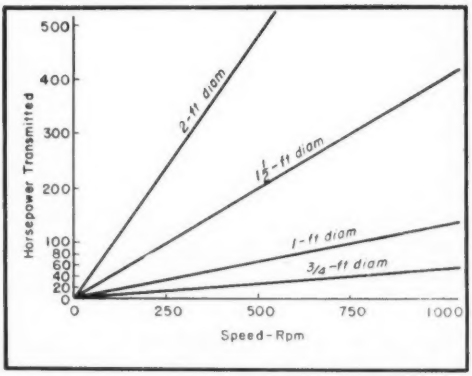
**ELECTRIC CO.**

*Sales offices in all principal cities*

**FACTORIES AT ST. LOUIS 20, MO. AND TORONTO, ONTARIO, CANADA**




**FLOATING PLATE** is between the magnet and the armature




**HORSEPOWER TRANSMITTED** depends on rpm and size of unit

shortest possible path through a high permeability metallic medium. Clutches, brakes, and reversing clutches are compact and operate on low current. A single unit, 6-in. diam with 1¾-in. shaft length, transmits 30 lb-ft (45 bhp at 3,000 rpm) using a current of less than 2 amp at 24v.

Since the torque is proportional to current passing through the unit, infinitely variable drive is obtained with a simple rheostat control.

# Derrick Platform Speeds Street Lighting Job

J. R. McTEER
Local Manager
South Carolina Power Co
Aiken, S. C.

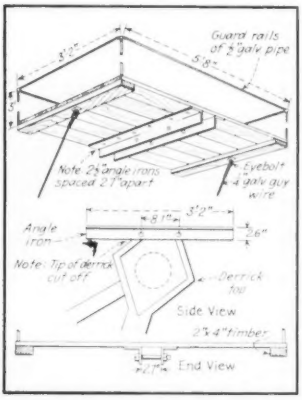
A PLATFORM MOUNTED on the tip of a truck derrick was one means by which an Aiken, S. C., whiteway system was completed in record time. The installation consisted of 86 26-ft steel standards with 7-ft arms, some double and some single, from which were suspended 600 cp luminaires. The series circuit was installed overhead with cable from the center of each standard to the luminaire.

One of the Aiken district line crews was confronted with the problem of installing the street lighting system. Since this was the first installation of this type in the territory, no suitable "aerial" equipment was immediately available.

Two members of the line crew, J. T. Townes, foreman, and C. B. Salley, lineman, thought of the idea of constructing a platform on top of the derrick on their construction truck (see illustrations). The platform consists of four creosoted boards bolted to two steel angles which are held in place on the end of the derrick by two pins. An eye-bolt is secured to each end of the platform to hold guys. The guys extend to supports on the rear of the truck to prevent side sway. A guard rail of ½-in. pipe was installed on the perimeter of the platform.

The angle irons on which the platform is bolted, consist of two discarded 44-kv steel crossarms which are spaced far enough apart to permit the end of the derrick being placed between them. The whole assembly is secured to the end of the derrick by means of two bolts as shown in the sketch in lower left corner of this page.

The platform was built from scrap material in about two hours. When put into operation it was found to be entirely satisfactory, durable and safe; in fact, it was capable of supporting three men.




**PLATFORM** attached to truck derrick facilitated installation of lighting system

**PLATFORM** construction (above) and mounting (below) on tip of derrick

# You can do a *lot*

## *with a little* GOLD SEAL TAPE

There's no use talking — Gold Seal sticks to the job. And being a *quality* tape, it goes further! There's no waste.

Production is carefully controlled to assure lasting "tack" in the friction compound . . . high dielectric strength. Gold Seal Tape will not dry out, ravel or peel. It tears evenly, quickly — speeds the job.

You get more tape value in every roll of Gold Seal. No wonder it's the lasting favorite of linemen and electricians. Try it, next time you want a tighter, longer-lasting bond. See if you don't agree: Gold Seal is the best buy in tape.

In single rolls and handy ten-roll containers. Each roll is cellophane wrapped — *factory-fresh*. Jenkins Bros. (Rubber Division), 80 White St., New York 13, N. Y.

Jenkins Bros. also make Diamond Seal Friction and Rubber Tapes which meet both ASTM and Federal Specifications.

JENKINS *Gold Seal* *Tape*

FRICTION and RUBBER TAPES

MADE BY JENKINS BROS. . . . MAKERS OF FAMOUS JENKINS VALVES

# LOAD BUILDING

## Meat Smoked and Cured Electrically

**HAMS** are smoked in 20 hr, bacon in 16, by the electric process developed by R. E. Dillinger, Public Service Co of Indiana. Note strip heaters and smoke pot between the meat racks. Smoke pot holds small range element, controlled by a thermostat, on top of which chips of wood are placed to smoulder

**R. E. DILLINGER,** Public Service Co of Indiana, shows proprietor how to handle controls of electric meat "smoking" process developed by Dillinger

MEAT SMOKED ELECTRICALLY was the result when Dewey Leonard of Sheridan, Ind., challenged the slogan "you can do it better Electrically." R. E. Dillinger, Manager, Public Service Co of Indiana at Sheridan, answered the challenge, although, he now admits, he did so with some misgivings.

The Sheridan Locker Plant, managed by Mr. Leonard, now cures hams in 20 hr, bacon in 16. Even temperature is maintained in the smoking room with low-surface strip heating units, 220-v, 750 w, grouped to balance a 7½-kw load on a 3-ph circuit. Two ordinary domestic thermostats control heater operation to a degree that was not possible under the old scheme for meat smoking. The assembly is plugged into a flexible conduit and can be removed during periodical room scaldings.

Danger of the fire from fats exposed to open flames, high insurance rates, quick burning of wood chips which should merely smoulder for good smoking of meats, and an order from the State Fire Marshal that these operations should be carried on in a separate building, were all factors which led to the plea by the locker people for a way of doing the job electrically.

Actual smoking is accomplished, without open flame, by a small 110-v range burner which is set in the smoke pot and covered with wood chips. Burner operation is controlled by a 100-w thermostat which has to be adjusted to the moisture content of the chips, some taking more heat and others less, to smoke freely without burning. This unit is removable for scalding and cleaning. It can also be removed during times when the room is filled with raw meats or emptied of cured meats.

Costs of smoking are low, approximately .315¢ per lb. Electric supply is single-metered. Proprietor of the locker plant estimates that the smoking and curing of 2,000 lb of meat requires 250 kwhr. Operating twice a week he uses about 5,000 kwhr per mo. Billing averages 2.5¢ per kwhr making each curing operation cost $6.25, or .313¢ per lb for meat cured.

But, other merits of the operation are rated ahead of its cheapness. Quickness, automatic control without need for such manual functions as tending a fire, and uniformity of results—all of these rate ahead of low cost for electricity. Having found the proper heat, time, smoke and moisture angles, the operator is able to settle upon them, so that his product next week will be exactly on a par with his product six weeks ago.

Public Service Co of Indiana reports that there are a great many food

PLEXIGLAS *diffusing panels in control room of Philadelphia Electric Company generating station. Large sections of white translucent* PLEXIGLAS, *installed below cold cathode tubes, give excellent glare-free illumination.*

# A Lighting Fixture as Big as the Room

# IT'S PLEXIGLAS

Here's the newest thing in large-area lighting—*pure illumination without glare or shadows*—diffused by large PLEXIGLAS plastic panels, installed wall-to-wall. And here's safety overhead, because PLEXIGLAS is light, strong, shatter-resistant.

Actually, white translucent PLEXIGLAS diffuses light so completely that shadows and glare simply vanish. Minimum absorption and maximum transmission of light give full, even illumination throughout any room. Brightness ratios are remarkably low.

PLEXIGLAS ¼" thick has seven times the impact strength of glass—yet weighs less than half as much. Light weight and shatter resistance permit its use in large sections with complete safety and ease, and economy of installation. Maintenance costs are negligible.

You'll find PLEXIGLAS wall-to-wall diffusing panels in banks, drafting rooms, stores, classrooms and control rooms—wherever *glare-free* lighting is desired, and safety with savings is essential. Tell us about *your* lighting problem. We'll be glad to send you full information regarding *modern* lighting with PLEXIGLAS.

CHEMICALS FOR INDUSTRY

**ROHM & HAAS COMPANY**

**WASHINGTON SQUARE, PHILADELPHIA 5, PA.**

*Representatives in principal foreign countries*

PLEXIGLAS *is a trade-mark, Reg. U. S. Pat. Off. and in principal foreign countries.*

*Canadian Distributor:* Crystal Glass & Plastics, Ltd., 282 St. Helens Avenue, Toronto, Ontario, Canada

locker plants in the area and that the electric "smoking" and curing idea is being studied by several of them. The company is cooperating with these other plants that are considering the use of electricity for curing and smoking meats. It feels this to be a good type of load, requiring very little special equipment investment.

## To Enlist Contractors in Wiring Campaign

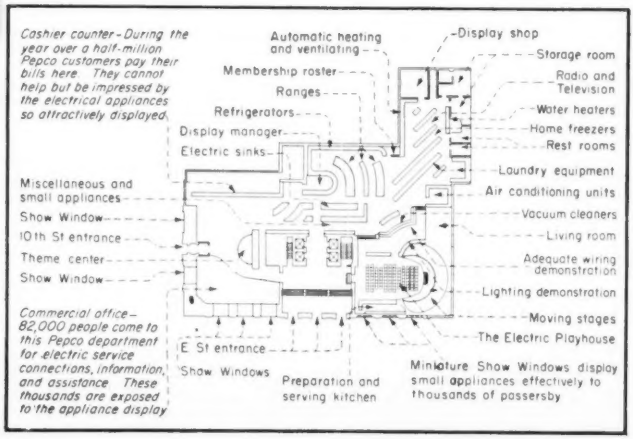
The whole industry is behind you—with
DYNAMIC ADVERTISING!
These BIG ads in City and Suburban newspapers will BREAK the ICE for your sales!
and YOUR NAME
The Evening Bulletin
The Philadelphia Inquirer
Philadelphia Daily News
These effective advertising hand-outs are for YOU—to give to YOUR OWN CUSTOMERS!
and MORE—

**CENTER SPREAD** of announcement booklet sent to contractors urging them to join fall wiring activity promoted by the Electrical Association of Philadelphia

ELECTRICAL CONTRACTORS in the Philadelphia area have a profit-plus inducement to inspire them to go after home wiring business this fall. The Electrical Association of Philadelphia has set up a promotion plan by which participating contractors are identified by name in metropolitan and neighborhood newspaper advertising and become eligible for money awards according to a point system based on the work they do during the campaign.

To enroll in the activity the contractor pays $25. For this money his name is listed with other participants in three separate advertisements placed in the three metropolitan newspapers. Also the contractor may select any one of 20 neighborhood and suburban newspapers to carry his name as a participant in 6 advertisements. He receives, in addition to the newspaper publicity, 50 copies of each of four promotional folders for mailing or handing to his prospects.

To benefit from the profit-plus feature of the activity, the contractor reports each residence wiring job on a point form. For increasing the service entrance to at least two No. 6 and one No. 8 conductors, including 60-amp, 230-v switch, provided that the increase is not required by installation of a major appliance, he enters 50 points. For each new branch circuit, again provided the circuit is not required by an appliance, 20 points. For each convenience or lighting outlet installed, 5 points, and 5 points for each 5 ft or major fraction of continuous multi-outlet assembly. For each 100 points thus accumulated during the period of the activity, the contractor receives $5, and for each home on which at least 100 points are earned he receives $3. Then at the end of the campaign, first, second and third prizes of $100, $75 and $50, plus 7 prizes of $25 each, will be awarded to the 10 contractors of highest point standing.


Cashier counter—During the year over a half-million Pepco customers pay their bills here. They cannot help but be impressed by the electrical appliances so attractively displayed.
Automatic heating and ventilating
Membership roster
Ranges
Refrigerators
Display manager
Electric sinks
Miscellaneous and small appliances
Show Window
10th St entrance
Theme center
Show Window
Commercial office—82,000 people come to this Pepco department for electric service connections, information, and assistance. These thousands are exposed to the appliance display
E St entrance
Show Windows
Preparation and serving kitchen
Display shop
Storage room
Radio and Television
Water heaters
Home freezers
Rest rooms
Laundry equipment
Air conditioning units
Vacuum cleaners
Living room
Adequate wiring demonstration
Lighting demonstration
Moving stages
The Electric Playhouse
Miniature Show Windows display small appliances effectively to thousands of passersby

## Effective Layout of Appliance Display Floor

CUSTOMERS of the Potomac Electric Power Co. coming to pay their bills or transact other business, are exposed to a powerful sales appeal in the appliance display. Floor plan shows the grouping of displays, how they are arranged for "pull-in" effect. Audiences of the Electric Playhouse (Electrical World, Jan. 8, 1949, pp 116-117) reach and leave the theatre through the display room. Nothing is sold here. Trained hostesses explain and demonstrate appliances, quote prices, and direct prospective buyers to member firms of the Electric Institute of Washington.

# NOW!-adaptable in seconds

***New Federal Noark QL Panelette gives you complete, time and money-saving flexibility***

THE REMARKABLE NEW NOARK QL Panelette is adapted to job requirements in seconds by snapping in Federal Noark Quicklag Circuit Breakers of the desired amperages. These Quicklags are rugged, factory-sealed units with fully dependable action . . . quick-make, quick-break insures positive action, longer contact life . . . high speed magnetic trip instantly clears heavy overloads . . . thermal trip holds harmless, momentary current surges yet trips on sustained small overloads.

2-, 4-, 8-, 16-, or 20-breaker capacity Panelettes can quickly be made up in any practical combination of 15, 20, 30, 40 and 50 ampere Quicklag units. Handle extensions give double-pole operation. Covers available for flush or surface mounting. Vacant breaker spaces for future expansion are covered with closure plates. Additional Quicklags are readily available from Federal jobber's stock.

Order Noark QL Panelettes from your Federal Distributor, and install them as the most modern, safe, expandable type of overload protection. Write us for descriptive booklet. Federal Electric Products Company, 50 Paris St., Newark 5, New Jersey.

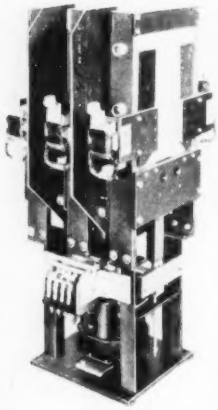
Federal NOARK

## FEDERAL NOARK

### QL PANELETTES

**Complete line of Federal Electric Products includes Motor Controls, Safety Switches, Service Equipment, Circuit Breakers, Panelboards, Switchboards, Control Centers, Bus Duct ★ Sales offices in principal cities.**

# NEW EQUIPMENT



## Air Brake Contactor

THREE PRINCIPLES of arc extinction are incorporated in a high voltage air break contactor. These include two breaks in series, magnetic blowout, and increased length of arc path.

This Type 256 contactor is 15x25x38 in. high. Arc chutes are said to withstand high arc temperatures and prevent production of arc-supporting gases. Mechanical and electrical interlocks are available for reversing or dynamic breaking service. ALLIS-CHALMERS MFG CO. S. 70TH ST. MILWAUKEE. WIS.

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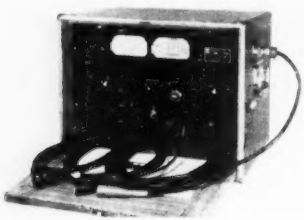


## Insulation Tester

FACILITIES for taking insulation resistance and dielectric absorption measurements on cables, transformers, machinery, and condensers are included in the portable tester Model 184 C. Breakdown voltages can also be found.

The unit provides continuously variable d-c voltages up to 10 kv. Regulation within 0.5% is accomplished by a constant voltage transformer. Resistance from 0.1 to 50,000 megohms may be read directly on a megohmmeter scale at open circuit voltages of 0.5, 1, 5 and 10 kv, or may be calculated in ranges from 0.3 to 20,000 megohms from the readings of a voltmeter and microammeter. The alternate methods are selected on one switch. Tester operates from 115-v, 60-cycle circuit, consuming 65 w max. RADIO FREQUENCY LABORATORIES INC, BOONTON, N. J.

•

## High-Current Rectifier

DUAL RECTIFIER ASSEMBLIES, incorporating selenium rectifier elements $7\frac{1}{4}$x$12\frac{3}{4}$ in., have been developed and are especially applicable for high current, intermittent duty, medium voltage (550 v and below).

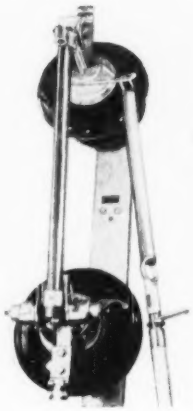
Each dual element actually consists of two of the company's largest size plates strapped in parallel. Elements are assembled in 3-phase bridge, 10-kw rectifier stack rated at 1,500 amp. Operating efficiencies of 85% are claimed. Weight per dual element of aluminum plates is 9 oz. INTERNATIONAL RECTIFIER CORP. 6809 S. VICTORIA AVE. LOS ANGELES 43, CALIF.

•

## Truck Body

A PUBLIC UTILITY BODY, Model 1978, is now available for installation on any standard $\frac{1}{2}$-ton truck chassis. Standard equipment includes material and tool drawers, first-aid kit holder, stationary bins, rear fenders, and material hooks and bins; optional are tarpaulin, ladder brackets, reel and holder, towing hook and other items.

Body is constructed of coated steel sheets joined by electric arc welds. Body dimensions are: 78 in. overall length, 59 in. outside width, $40\frac{1}{2}$ in. high; weight is 975 lb. net. YORK-HOOVER CORP. YORK, PA.



## Fuse Jumper

A TYPE JDM fuse jumper has been designed to shunt outdoor power fuses and avoid service interruptions while fuse elements are being inspected or replaced.

This jumper consists of two terminal rings connected through a bakelite tube by a flexible shunt. Spring loaded to develop contact pressure, it is available for all voltages from 34.5 kv through 161 kv and can be used with fuses of any manufacturer using NEMA standard insulators. With slight modification existing fuses can be adapted for use of this jumper. SOUTHERN STATES EQUIPMENT CORP. HAMPTON, GA.

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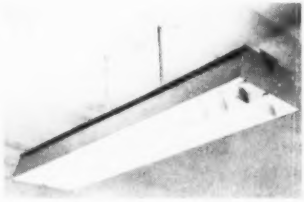


## All-metal Luminaire

IN the design of an aluminum fluorescent luminaire approximately 13% of the total light output is directed upward to minimize ceiling-luminaire contrast. Baffles may be attached to reflector top for direct lighting.

Called the "Berkeley", it can be

# DRIVEPOINT!

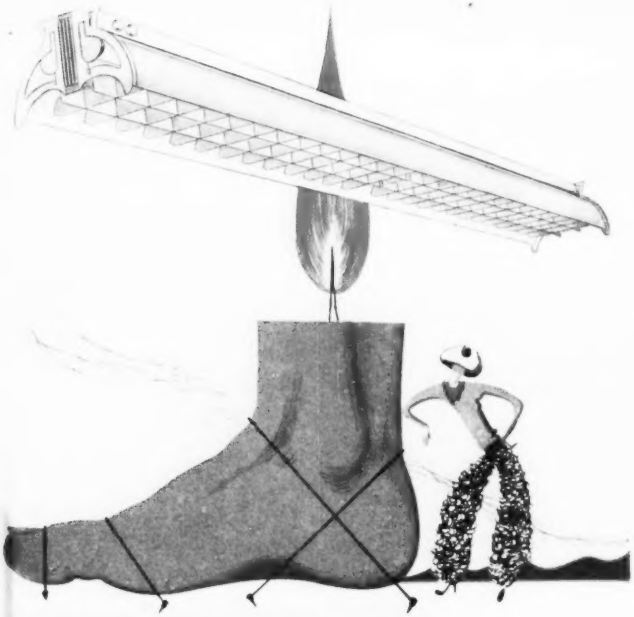
*look for it on all*

**HUBBARD BOLTS**

*How it helps YOU!*

Easier, faster starting of nuts.
Acts as a Drift Pin.
Protects thread when bolt is driven out or when stud bolts are driven in.
Drivepoint finds the hole—easier, quicker installation.
Costs no more than ordinary machine or crossarm bolts.

HUBBARD AND COMPANY
PITTSBURGH CHICAGO OAKLAND CALIFORNIA



# GUTH FUTURLITER*

## corrals wayward footcandles ...saves steps for eyes!

It beams 80% of the footcandles directly down on the working area...directs 20% upward for eye-easy brightness ratios.

Its dust-discouraging design and hinged eggcrate louvres make it one of the easiest of all fluorescents to keep clean and efficient. Versatile, too...you can mount the Futurliter in units or rows, surface or suspended.

"Eye-to-the-Future" Futurliters give a lighting system flexible footcandle capacity. Up to 45% more light can be had by adding a third lamp to two-lite units.

You'll find detailed data in our handy new Pocket Catalog 46A-H...yours with the compliments of

Guth LIGHTING

YOUR TEAMMATE IN *precision-planned* LIGHTING

THE EDWIN F. GUTH COMPANY / ST. LOUIS 3, MISSOURI

*Leaders in Lighting Since 1902*

014

suspended with twin-stem or single-stem hangers, or surface-mounted without hangers. Continuous rows can be formed by joining the luminaires end-to-end with stem connector hangers. Louver assembly drops down on a chain for easy access to wiring channel. Two 40-w general line fluorescent lamps are used with the Berkeley. It is said to be applicable for schools, stores, offices, and commercial interiors. THE MILLER CO, MERIDEN, CONN.

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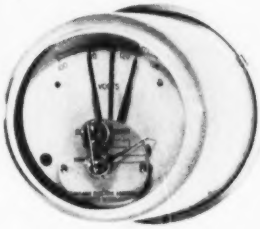


## Max.-Min. and Graphic VM

AN indicating maximum-minimum voltmeter and a graphic voltmeter have been designed to provide information for setting voltage regulators and for other voltage control problems. Meter shown is time-lagged Lincoln Type V-28. The two pointers show the average voltage over the 10 min period of highest voltage and lowest voltage. Pusher pointer shows average voltage at any time.

Graphic voltmeter, Type CCV, is also time-lagged and is equipped with a continuous recording pen, any point on the curve being the average over the previous 10 min. Both voltmeters with-

### WHAT'S AHEAD in New Equipment

**AIR DISCONNECT SWITCH**
Sealed pressure hinge contact eliminates second break contact

**POLE BUTT GROUND PLATE**
Spiked projections reduce resistance

**STREET LIGHTS**
F lamps used in post mounting

**INDUCTION MOTORS**
Stator frames are solid rolled steel

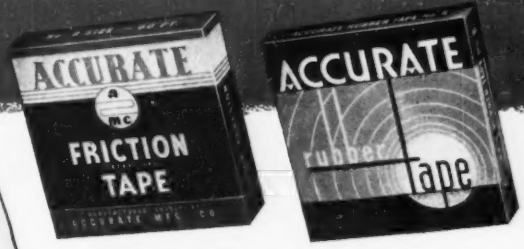
**WOOD STRAIN INSULATORS**
"Squeeze" is from all four sides

**OSCILLOGRAPH**
Galvanometer has bifilar suspension

**RECESSED TROFFERS**
Units feature ladderless maintenance

**SMOKE DETECTOR**
Alarm rings if air has 3% smoke

# ACCURATE TAPES




## WORK BETTER
**—because they're made better!**

TAKE A GOOD LOOK AT THE TAPE YOU USE—

Every package of ACCURATE tape helps you produce better taped joints in less time. You know this as soon as you've stripped the first length off a new roll. The tape peels off straight and neat without ravelling —tapes up tight and even on the joint —and breaks clean right where you tear it. ACCURATE tapes work better because they're made by men who specialize in tape making.

**—if it's**
## ACCURATE TAPE
**here's what you'll find!**

First you'll see proper protective packaging. Substantial protective carton; heavy cellophane wrapper inside. Hold a length to a bright light—no pinholes anywhere. Then, when you use it, you'll notice ACCURATE tape never creeps or ravels and breaks off straight and neat. There's more than meets the eye, too. Every foot of ACCURATE tape is made to ASTM Standards and every roll contains guaranteed footage. That's why—when you buy ACCURATE tapes—you get real tape value. Next time you need tape—order ACCURATE. Write for catalog and name of distributor nearest you.

PROTECTIVE PACKAGING

DIELECTRIC STRENGTH

HIGH TENSILE

EASY TEAR-OFF

NON-DETERIORATING

EASE OF APPLICATION

**ACCURATE MFG. COMPANY**

GARFIELD, NEW JERSEY

25 YEARS MAKING TAPES EXCLUSIVELY

# The man on the pole will tell you- KLEINS

If you know linemen, you know they want the finest in quality when it comes to equipment. Not only does their job depend on it—many times their lives do.

It is the reputation of nearly a century in designing and manufacturing the finest in linemen's equipment that has won Klein its position of preference with linemen and electricians everywhere.

It is easy to make equipment that looks like Kleins. It takes years of experience plus extensive manufacturing facilities to make equipment that performs like Kleins.

Today you are assured prompt delivery on all Klein products. Be sure your pliers, climber straps, safety belts and other items carry the Klein trade-mark—famous for quality "since 1857."

**ASK YOUR SUPPLIER**
**Foreign Distributor:**
**International Standard Electric Corp., New York**

*The Klein Pocket Tool Guide showing the Klein line and containing useful tool information will be mailed on request.*

**Mathias KLEIN & Sons**
**Established 1857** **Chicago, Ill., U.S.A.**
3200 BELMONT AVENUE CHICAGO 18 ILLINOIS


stand 12 kv surges and are temperature compensated for outdoor use. Meters with voltage ranges of 95 to 135 v, or 190 to 270 v are available. SANGAMO ELECTRIC CO. SPRINGFIELD, ILL.

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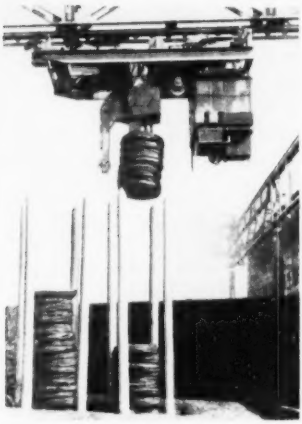

## Vertical Stacker

STORAGE CAPACITY of rod or wire warehouses can be increased about 25% according to the manufacturer of a vertical stacking hairpin hook and carrier.

Stacking unit will handle 10 coils of 330 lb each at a time, picking them from horizontal position on floor or in gondola car and placing them in vertical piles supported by floor posts. The unit will also lift off the coils from the vertical piles and place them into a horizontal position. Grab mechanism is hydraulically actuated. A spreader plate in an expanded position, exerts pressure against inside diameter of coils to hold them during handling.

First installation, shown above, was in a building with a truss height of 40 ft in which rod can be stored to a 22-ft height. THE CLEVELAND CRANE & ENGINEERING CO, CLEVELAND TRAMRAIL DIV, WICKLIFFE, OHIO.

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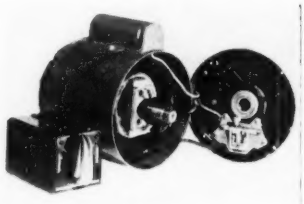
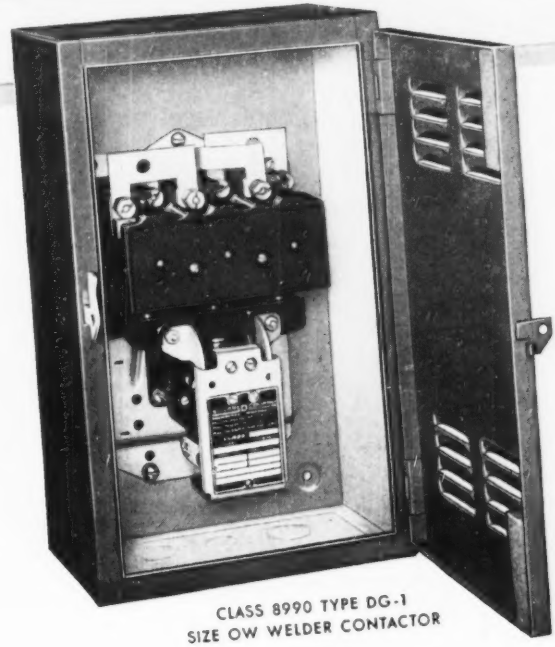


## Motor Switch

AN ELECTRIC SWITCH, tradenamed "Reverswitch", has been developed to start a motor in either direction, reverse it instantly, or bring it to a quick stop.

# NOW a 50-ampere Contactor FOR SMALL SPOT WELDERS



CLASS 8990 TYPE DG-1
SIZE OW WELDER CONTACTOR

## SAVE 3 WAYS

**WITH NEW SQUARE D HIGH SPEED CONTACTOR**

- LOW COST
- SMALLER SIZE
- MINIMUM MAINTENANCE

Specify new CLASS 8990 TYPE D MAGNETIC WELDER CONTACTORS to handle transformer primaries of spot welders rated approximately 10 KVA, 220 volts; 20 KVA, 440 volts and less. For fully automatic control at minimum expense use them with Square D's popular Safront timers.

Simple vertical action, short stroke, hardened parts, and complete accessibility contribute to long life with low maintenance cost. Contacts and coils are interchangeable with Square D Size II motor starters.

For installation economy, device is single pole with two double-break contacts in series, giving high interrupting capacity.

## The BEST Resistance Welder Control?

● There is no one type. Square D builds both magnetic and electronic controls of many types—each best suited to certain types of applications. Specify Square D, and be sure of getting the best for your job.

HIGH SPEED CONTACTORS
MOTOR DRIVEN TIMERS
Safraat TIMERS
Electronic TIMERS & CONTACTORS
SYNCRO-BREAK CONTACTORS
SYNCHRONOUS-PRECISION COMBINATION CONTROLLERS

TYPE TBS-6 SAFRONT WELD TIMER for foot-operated machine

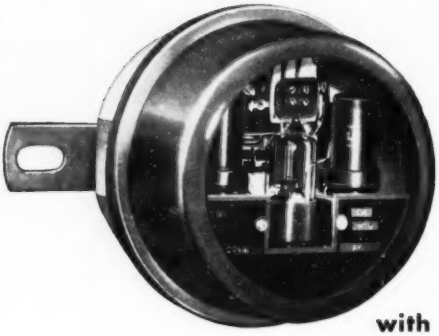
*Write* for BULLETINS 8990 and 211 on contactors and BULLETIN 210 on Safront timers. Square D Company, 4041 North Richards Street, Milwaukee 12, Wisconsin

SQUARE D COMPANY

DETROIT • MILWAUKEE • LOS ANGELES

SQUARE D COMPANY CANADA LTD., TORONTO • SQUARE D de MEXICO, S.A., MEXICO CITY, D.F.

# REDUCE your street light control COSTS



with

## FISHER-PIERCE PHOTOELECTRIC CONTROLS

Improved lighting service is available to cities and towns through the use of photoelectric controls by Fisher-Pierce. These units are giving continuous, positive service in hundreds of modern applications . . . regardless of weather, climate or daylight conditions.

Approved by cost-conscious engineers, Fisher-Pierce controls offer a simplified photo-relay for control of multiple or series street lighting systems. F-P economies include long tube life (20,000 hours or more), easy servicing (simple plug-in chassis construction), *no resetting after power interruptions.* In other words, exceptionally *low maintenance costs.* We'd like to give you details on our units for improved street lighting. A request will bring full information promptly.

FP *The* FISHER-PIERCE COMPANY, INC.

82 CEYLON ST., BOSTON 21, MASSACHUSETTS


This switch is reported to give split-phase and capacitor-start motors the reversing characteristics of 3-phase motors. Action is similar to conventional mechanical starting switches except that two contacts are used. IRON FIREMAN MFG CO, PORTLAND, ORE.

•

### Aluminum Aerial Ladder

AN aluminum platform ladder has been designed for mounting on a truck body. Some models have 360-deg rotation. Lengths are available up to 60 ft, with lateral inclination controlled manually or hydraulically by as much as 14 ft. AERO METALCRAFT CORP, ROCKLEIGH, N. J.

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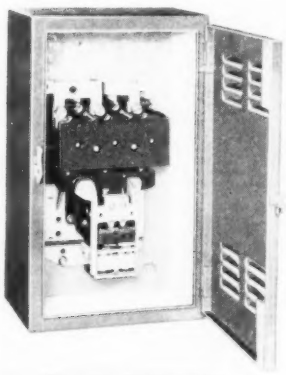

### Welder Contactor

A 50-AMP WELDER contactor Size OW is now in production for spot welding machines up to 10 kva at

220 v, or 20 kva at 440 v.

Two double-break silver contacts are connected in series, giving a total of four breaks, to provide high rupturing capacity. Heavy copper bus straps are provided for large welder cables. Maintenance is facilitated since the movable contact assembly, terminals, contacts and magnet coil can be removed with a screwdriver. SQUARE D CO. INDUSTRIAL CONTROLLER DIV. MILWAUKEE 12, WIS.

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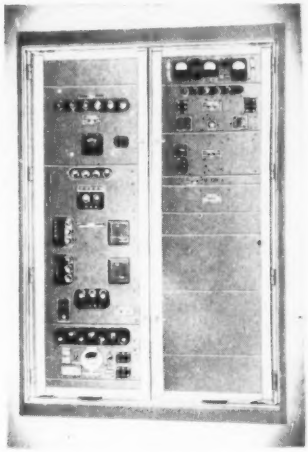


## Duplex Carrier Equipment

TYPE JY single-sideband duplex transmitter-receivers are intended for all types of communication between substations and main plants.

Full duplex operation is secured with an 8 to 1 gain in signal-to-noise ratio over standard AM carrier. It is also claimed that corona modulation is greatly reduced because the carrier is suppressed.

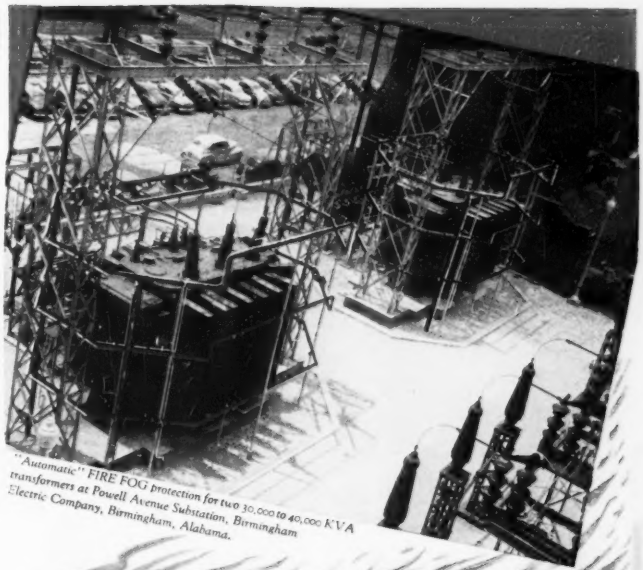
Extensions ring in accordance with a transmitted code when magneto-type generator is cranked. The equipment can be coordinated with existing telephone facilities through PBX boards. WESTINGHOUSE ELECTRIC CORP, Box 868, PITTSBURGH 30, PA.

•

## Safety Switch

A HIGH CAPACITY interrupter (HCI), Type A Safety Switch for use in industrial distribution systems is now available.

Manufacturer's engineers explain that magnetic repulsion action makes possible the quick breaking of heavy loads. Further, the actuating mechanism provides positive quick-make,

"Automatic" FIRE FOG protection for two 30,000 to 40,000 KVA transformers at Powell Avenue Substation, Birmingham Electric Company, Birmingham, Alabama.

Ready, Willing and Able
TO COMBAT ELECTRICAL EQUIPMENT FIRES

Only a hint of flame at this bank of high voltage transformers and—quick as a flash, *Automatic* FIRE-FOG goes into action. From strategically positioned nozzles, a concentration of fine water spray is directed at the blaze. Flames are forced down . . . the fire area cooled. In but a matter of seconds, extinguishment is complete and damage to equipment confined only to the point of fire origin. Even out-of-service time has been held to a minimum.

Automatic
FIRE-FOG
-IT BLANKETS -IT ISOLATES -IT QUENCHES-

. . . a famous member of the *"Automatic Sprinkler"* Family . . . provides basic fire protection for process equipment and storage in the chemical and petroleum industries. On-the-spot protection for quench tanks, dryers, explosive hazards, conveyor openings, air filters, oil filled electrical equipment and other units vital to production line operations.

Although a relatively new development, *Automatic* FIRE-FOG is widely recognized by both utility companies and private users. Designed specifically for your particular risk it is electrically safe and carries the approval of all leading insurance authorities.

More detailed information, especially as to how *Automatic* FIRE-FOG can serve your needs is available upon request and surveys and estimates will be furnished without cost or obligation. Write today.

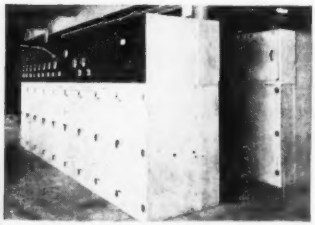
"AUTOMATIC" SPRINKLER CORP. OF AMERICA
YOUNGSTOWN 1, OHIO

"Automatic" Sprinkler
FIRST IN FIRE PROTECTION
DEVELOPMENT . ENGINEERING MANUFACTURE . INSTALLATION
OFFICES IN PRINCIPAL CITIES OF NORTH AND SOUTH AMERICA

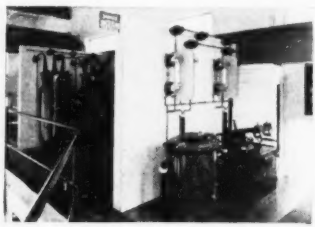
## WHY STATION EXPANSION PROGRESSES FASTER . . . COSTS LESS

## with Trancell Materials

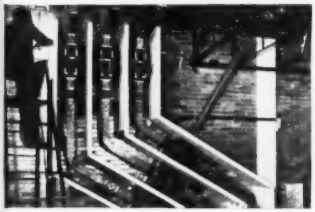
If you're planning to expand your power stations or substation facilities, do what many leading power companies have already done . . . make your station change-overs with Johns-Manville Trancell Materials.



**They're safe**—fireproof . . . have low heat conductivity . . . adequately isolate high-voltage apparatus.

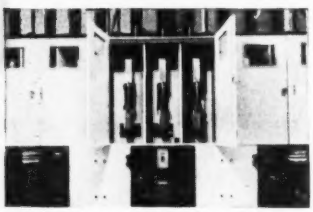


**They're neat**—make clean, flush-type housings, panels, doors, and partitions.



**They're handy**—easily cut and drilled on the job, or furnished cut to your specifications.

**They're durable**—rotproof and rustproof . . . will last for years. Require a minimum of maintenance.



**They're economical**—light, easy to handle and assemble. Have excellent re-use value.

**—for all high voltage power equipment enclosures**—Johns-Manville Trancell Materials are made in many sizes and types. Recommended for transformer and switch gear housings and partitions; bus bar enclosures and other services. For further information write to Johns-Manville, Box 290, New York 16, New York.

JM

**Johns-Manville**

**TRANCELL**

**an asbestos product for housing electrical equipment**


quick-break action by means of a roller-cam, multiplying linkage design combined with a powerful spring.

Switches are made in 30, 60, and 100-amp sizes and are Underwriters' approved. Additional information is in Bulletin TEC-10. The Trumbull Electric Mfg Co, Plainville, Conn.

## MORE NEW PRODUCTS
### about which you should know

Industrial Electronics & Transformer Co, 1801 E. Slauson Ave, Los Angeles 11, Calif, has designed a selenium rectifier **cathodic protection unit** specially suited to high temperature operation; output is continuously variable from 0 to 15 v with input of 110 v a-c . . . Weldron Co, 703 Industrial Trust Bldg, Providence 3, R. I., is now marketing a portable **spot welder** which they say weighs less (14½ lb) and costs less than any unit of equal capacity available; can be plugged into any 115 v, 60 cycle, 25 amp outlet.

Clough Brengle Co, 6014 Broadway, Chicago 40, Ill, has announced an **audio sweep generator** having a frequency range of 25 to 32,000 cycles which may be operated either automatically or manually; complete data in Bulletin 32 A . . . Irvington Varnish & Insulator Co, Irvington 11, N. J., has a flexible **plastic tubing** to replace fiber conduit and fiber and steel elbows formerly used on cable riser poles.

Westinghouse Electric Corp, Box 868, Pittsburgh 30, Pa., is offering a new Type CSP **motor** especially for deep-well turbine pumps and other applications where a constant speed motor is required. These weather-proof squirrel cage motors have vertical hollow shafts and are available from 1 to 20 hp . . . Eriez Mfg Co, 1070 E. 12th St, Erie, Pa., has a redesigned line of permanent non-electric Alnico **plate magnets** which they claim have a 50% greater magnetic strength with a 30% decrease in weight; sizes from 4 to 72 in. in 2-in. increments.

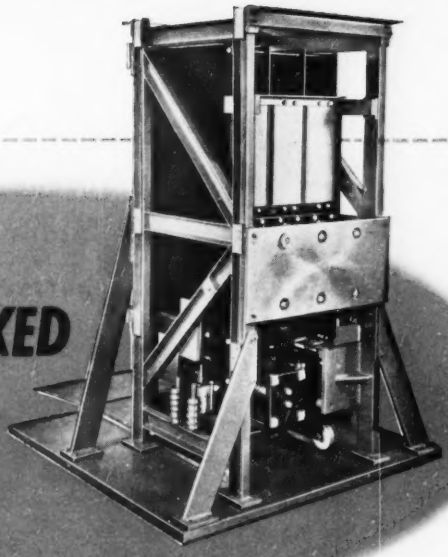
General Electric Co, Schenectady 5, N. Y., has developed a brush stabilizing mechanism which is reported will more than double the life of **brushes** and commutators in series-wound, heavy-duty motors. Intended for fractional-hp motors, the mechanism causes brush to ride freely in its holder by counteracting wedging effect of the commutator . . . Another G. E. Co development is a miniature inert-arc **electrode holder** with flexible "goose neck" for the fluxless welding of non-

YOU CAN BE **SURE**.. IF IT'S

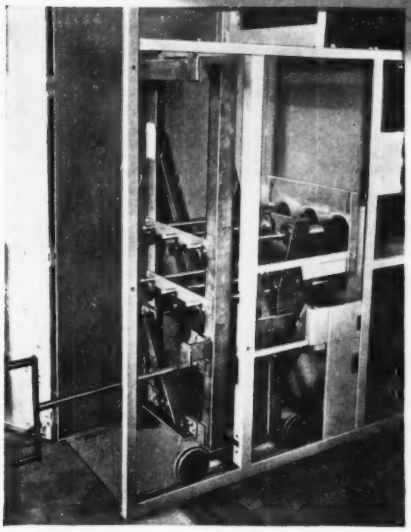
Westinghouse

Switchgear Removable Element—
Stationary Structure Alignment

# It's DOUBLE CHECKED for SURE fits!



Every removable element must fit perfectly into a master switchgear stationary structure.



Every stationary structure is checked for alignment with a master removable element.

A system of rigid double-checking in the assembly of Westinghouse Metal-Clad Switchgear assures you of this important operating benefit. Removable elements that fit *perfectly* into *any* stationary structure of like rating.

This perfect alignment is accomplished, first, by fitting all removable elements to a master stationary structure in the breaker assembly section; second, by matching all stationary structures to a master, tool-built, removable element in assembly operations. The result is positive alignment of rails and wheels; main, auxiliary and ground contacts; shutter and main levering-in device.

These master tool elements are checked against each other periodically with precision "go—no go" gauges to insure that their accuracy is maintained.

Double-checking for "sure fits" eliminates the necessity for fitting on the job. It provides for swift, easy, interchangeability of breakers when the switchgear is in service. It's another means of making you *sure* when you specify Westinghouse Metal-Clad Switchgear.

For complete information about the 10 big advantages of Westinghouse Metal-Clad Switchgear, send for booklet B-4016. Address Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pennsylvania.

I-60692

Westinghouse
"UNITIZED"
METAL-CLAD
SWITCH GEAR

This *Phenolite* Insulator * licked our production headache in a hurry.

* Required:
*A material with very high insulation resistance under all atmospheric conditions—with good mechanical strength and ready machinability. Phenolite, laminated plastic, with all these qualities, plus—was the perfect answer.*

**In your development of efficient, economical products, it pays to investigate**

**PHENOLITE** Laminated PLASTIC

About one-half the weight of aluminum, possesses an unusual combination of properties—a good electrical insulator, great mechanical strength, high resistance to moisture; ready machinability. Sheets, Rods, Tubes, Special Shapes.

**NATIONAL VULCANIZED FIBRE**

A tough, horn-like material with high dielectric and mechanical strength. Excellent machinability and forming qualities, great resistance to wear and abrasion, long life, light weight. Sheets, Rods, Tubes, Special Shapes.

**PEERLESS INSULATION**

The *first* fish paper developed for electrical insulation. Strong, smooth, flexible, with excellent forming qualities. High dielectric strength. Sheets, Rolls, Coils.

*To help you solve your specific development problem—available without obligation—National Research and Engineering Service.*

NATIONAL VULCANIZED FIBRE CO.
WILMINGTON DELAWARE
Offices in Principal Cities
Since 1873

ferrous metals up to 0.0625 in. thick; rated at 40 amp continuous, a-c or d-c.

FRED H. SCHAUB ENGG CO, 2110 S. MARSHALL BLVD, CHICAGO 23, ILL., has produced a **lining material** called Chromasoid for corrosion prevention on condensate tanks and return system receivers. Inert to chemical reagents, it is reported not to affect the water and withstands 500 F . . . INDEPENDENT PNEUMATIC TOOL CO, 175 N. STATE ST, AURORA, ILL., has announced a **pneumatic tool** which drives "screwsticks", a series of hexagonal head screws joined head end to thread; Thor driver eliminates picking up and starting each screw by hand.

LEWIS-SHEPARD PRODUCTS INC, WATERTOWN, MASS., has a portable **"Handy Hoister"** of 1,000 lb capacity with 24 x 30 in. lift platform, lowered height of 5½ in. and lifting height of 58 in.; overall height is 76 in. . . . FLEXO MACHINES CO, 456 N. ABERDEEN ST, CHICAGO 22, ILL., is marketing a **wire-rope swivel** with double roller bearings for all rope applications; five wire-rope sizes from ½ to 1½ in. are available.

AMERICAN HOIST & DERRICK CO, ST PAUL 1, MINN., is manufacturing Model 410 10-ton **diesel locomotive crane** with 40-ft boom at 12-ft radius; can shift to any of three speeds while crane is in motion . . . STA-WARM ELECTRIC CO, RAVENNA, OHIO, offers compound and **wax dispensing units** for such operations as transformer potting, condenser, brush and switch manufacture; 2 qt to 25 gal capacity with thermostat allowing temperature selection in 150-450 or 250-550 F ranges.

HYKON MFG CO, ALLIANCE, OHIO, is selling a **wire measuring unit** complete with wire meter and storeroom reel; wire and cable sizes to 1-in. diam can be measured and registered up to 1,000 ft . . . GENERAL ELECTRIC CO, SCHENECTADY 5, N. Y., has announced a **timing switch**, Type T-470, which regulates lighting in poultry houses; operates with synchronous, self-starting motor, 30 amp, 115 v.

LINDBERG ENGG CO, 2444 W. HUBBARD ST, CHICAGO 12, ILL., offers Type LI-25 **induction heating unit** rated at 25 kw with normal frequency of 450 kc operated from 3-phase, 60 cycles at 230, 460, or 550 v. Further information in Bulletin T-1420 . . . SYLVANIA ELECTRIC PRODUCTS INC, SALEM, MASS., has placed 4-ft, 40 w and 6-ft, 60 w Slimline **fluorescent lamps** on the market similar to their larger sized T-12 lamps.

METROPOLITAN ELECTRIC MFG CO, 22-50 STEINWAY ST, LONG ISLAND CITY 5, N. Y., is making a standardized **unit board** with "Lo-Ohm" quick make, quick break switches housed in the units in capacities of 30 to 200 amp, 250 v; 400 and 600 amp units will be available soon.

# OVER 78 WAYS TO MAKE SURE CONDUITS STAY PUT!

## O.Z. has 'em ...IN STOCK

**When you need U-BOLTS for that conduit or cable clamping job, try O-Z.**

**WHY?**

**BECAUSE** the O-Z line is *in stock*, ready for immediate shipment.

**BECAUSE** the stock O-Z line has over 78 sizes and types for conduits from ½" to 6". As just one example, you can get *three* bolt diameters, for 1", 1¼" or 1½" conduit. You can get O-Z U-BOLTS, from stock of Everdur, steel cadmium plated or steel hot-dip galvanized. They come with nuts and flat washers, with or without saddles. They provide for clamping to a ⅜" thick plate using nuts and washers on each leg.

**BECAUSE** O. Z. will manufacture U-BOLTS of any size or material to meet your specifications.

There are thousands of O-Z products designed to help you put power where you want it, and your O-Z Distributor is the man to see about them. Send for illustrated catalog.

and Remember!

**THEY'RE O.K. IF THEY'RE O.Z.**

**O.Z. ELECTRICAL MANUFACTURING COMPANY, INC.**

262 BOND STREET BROOKLYN 2, N. Y.

CONDUIT FITTINGS
CABLE TERMINATORS
CAST IRON BOXES
GROUNDING DEVICES
SOLDERLESS CONNECTORS
POWER CONNECTORS

5069

# NEWS ABOUT PEOPLE

## McCumber Directs Electric Operations in Rochester

Ralph McCumber, who has been general superintendent of the electric department of the Rochester Gas & Elec-

RALPH McCUMBER

tric Corp, Rochester, N. Y., has been made general manager of all electric and steam operations. He has been with the company 26 years.

Mr McCumber has also been appointed to the management council of the company.

•

**Lansing T. Smith** has been appointed aassistant to the general manager of the Gulf Power Co, Pensacola, Fla. He has been with the company since 1926. **Roger Q. Scott** has been named manager of retail operations. He has been with the company for 11 years.

**Willis D. Gale** has been elected to the new position of chairman of the finance committee in both the Commonwealth Edison Co and the Public Service Co of Northern Illinois. The position in each company of vice-president in charge of finances, formerly held by Mr Gale, has been abolished.

**E. G. Rush**, for several years manager of the Southeast Colorado Power Association at La Junta, Colo., has arrived in The Dalles, Ore., to assume management of the North Wasco PUD.

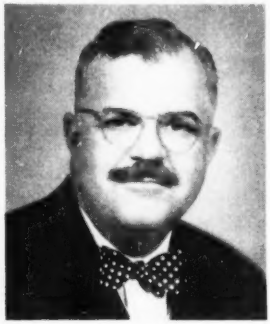
**Eric G. Peterson** has been appointed general manager of the Peabody Engineering Corp, New York. Mr Peterson will continue as general sales manager of all products in all divisions. After several years in power plant work in South America, he became associated with the Peabody organization in 1928 in the capacity of engineer, later transferring to the sales department. Mr Peterson will make his headquarters in the executive offices of the corporation.

•

## Buckingham Directs Sales for Iowa Electric Light

Robert L. Buckingham has been appointed director of sales for the Iowa Electric Light & Power Co, Cedar Rapids, to succeed the late J. P. Walters.

Until recently, Mr Buckingham was vice-president in charge of sales for the



ROBERT L. BUCKINGHAM

Rapid Thermogas Co, an LP gas organization, operating in Iowa and Wisconsin. Early in his career he was associated with Armour & Co and later founded Buckingham & Associates, Inc, a sales counselling service.

•

**E. E. Gamet**, for the past year city manager at Slater, Mo., has been appointed superintendent of the Northeast Missouri Electric Power Co-op at Palmyra, Mo.

**George S. Jones, Jr.**, vice-president and assistant to the president of Servel, Inc, Evansville, Ind., has been named chairman of the National Distribution Council, the official advisory body to the Department of Commerce.

## Ross Named Washington Correspondent for EW

Ronald D. Ross now is reporting the news in the nation's capital for ELECTRICAL WORLD.

A native of Iowa, Ross has been a member of the Washington press corps

RONALD D. ROSS

for the past three years. He resigned as news editor of Science Service, Washington, to join the staff of the Washington Bureau of the McGraw-Hill Publications.

His new duties include covering news of, and of interest to, the electric industry in Washington for ELECTRICAL WORLD and other McGraw-Hill magazines. He succeeds W. B. Whichard, who has joined WORLD's New York staff as an associate editor.

A graduate of Iowa State College, Ross served three years with the Navy during World War II, taking part in the invasion of Normandy and other operations in the European theatre. As a reporter and editor in Washington, he covered engineering and scientific news, as well as political events.

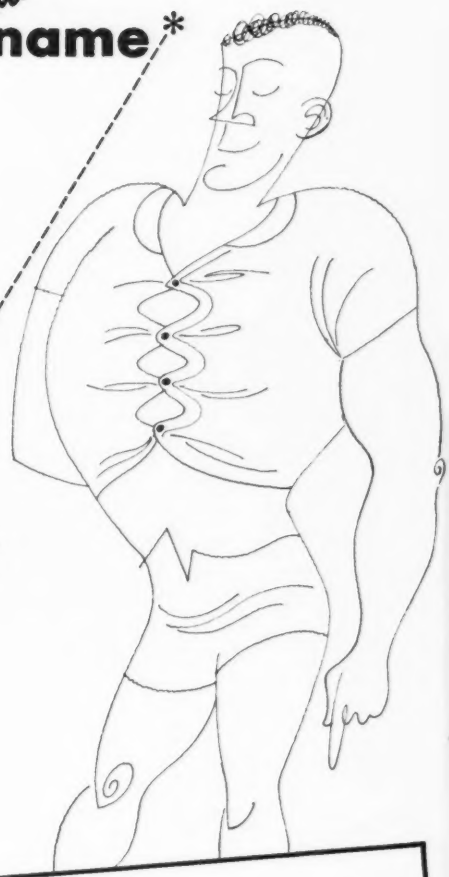
•

**Roy S. Glasgow**, former chairman of the Department of Electrical Engineering, Washington University, St. Louis, has been named academic dean of the United States Naval Postgraduate School, Annapolis, Md.

**A. H. Forman, Jr.** has been appointed assistant to the president of the Central Arizona Light & Power Co, Phoenix. Mr Forman was formerly assistant to

# Polyken®

## ...is my new name*



Everybody outgrows his britches sometime. I did it faster than most . . . thanks to your ever-increasing demands for Bauer & Black industrial tape.

**So now I'm getting a new name . . . and clothes that fit. In other words . . . we've formed a new department with separate headquarters . . . under our own trade name . . . POLYKEN.**

As new uses for industrial tapes are developed, we will continue to add specialty and standard tapes to our already broad line. And as an expanded department, we want to continue helping you in industry to cut costs . . . speed and improve methods.

**Accordingly, Bauer & Black is pleased to announce that . . .**

***BAUER & BLACK Industrial Adhesive Tape** will now be sold under the following trade name:

**Polyken®**
**INDUSTRIAL TAPE**

DEPARTMENT OF
**BAUER & BLACK**
DIVISION OF THE KENDALL COMPANY
222 W. ADAMS ST., CHICAGO 6

**THERE'S A Polyken TAPE FOR YOUR JOB!**
(Or if there isn't, we'll make one.)

# Case History*

## *of*

## *Untreated versus Treated Poles*

**1925** **1946**

**51 Untreated Poles Placed . . . 19 Poles Still Serviceable**
(Northern White Cedar)

**607 Treated Poles Placed . . . 600 Poles Still Serviceable**
(Southern Pine)

**AND *Creosote***
**MADE THE DIFFERENCE!**

In 1946, after 21 years in line—600 out of 607 Pressure-Creosoted Poles were still serviceable. And of the 7 poles no longer in service, 5 had been removed because of a grade crossing clearance—2 because of an accident. *Not a single one* of the 607 poles had been removed because of deterioration due to treatment or preservative failure—a 100% record for creosote.

And when it comes to creosote, you get the best possible delivery service from Koppers. With 14 creosote-producing plants—with 4 large storage plants—Koppers can supply you with creosote *where* you need it—*when* you need it.

Koppers is the nation's largest distributor of creosote. So remember—you can always count on Koppers to help you maintain your production schedules.

**KOPPERS COMPANY, INC. · Pittsburgh 19, Pa.**

*Proceedings of the American Wood Preservers' Association—1947.

All Standard Specifications
For All Types of Wood Preservation

**KOPPERS CREOSOTE...*to be sure*!**


the vice-president of the Mississippi Power & Light Co, Jackson, Miss. He became associated with the Mississippi company in 1929.

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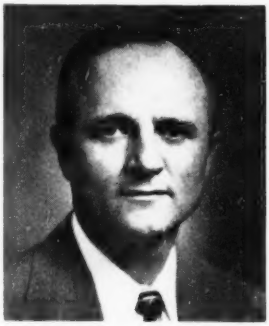
## Westinghouse Announces Engineering Appointments

Two executive appointments in the industry sales departments of the Westinghouse Electric Corp were made re-



R.S. KERSH

cently. **R. S. Kersh** has been appointed manager of central station sales and **F. D. Weatherholt** manager of industrial sales. Both will be located at the East Pittsburgh plant.

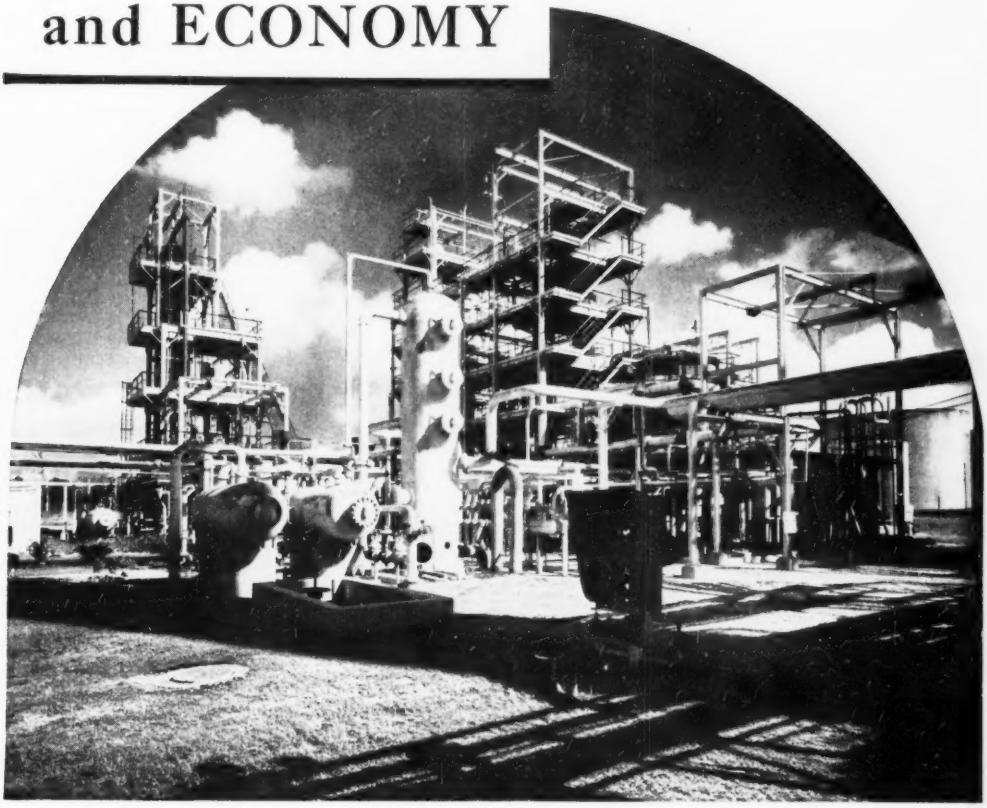
Mr Kersh joined Westinghouse in 1929. Since 1947 he has served as manager of industrial sales at East

F. D. WEATHERHOLT

Pittsburgh. Mr Weatherholt became identified with Westinghouse in 1921. Except for a short period at the company's Springfield (Mass.) Works, most of his career has been in various sales capacities with the company's Eastern District offices. Since 1948 he has been assistant manager of industrial sales at East Pittsburgh.

Appointment of **G. L. MacLane, Jr.** as manager of the engineering laboratories has been announced. Mr Mac-

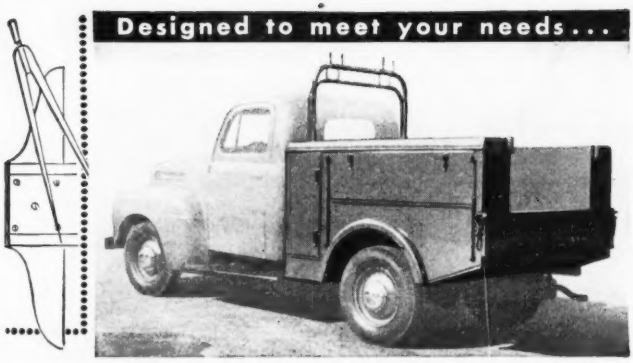
# EFFICIENCY and ECONOMY



IN the planning and execution of expansion programs, Stone & Webster Engineering Corporation offers to industrial organizations the efficiency and economy resulting from a competent and coordinated engineering and construction staff with broad experience in all phases of design and construction.

STONE & WEBSTER ENGINEERING CORPORATION

A SUBSIDIARY OF STONE & WEBSTER, INC.




**UTILITY BODIES...BUILT FOR YEARS OF SERVICE**

Steel bodies expressly designed to save time — conserve manpower — provide a place for everything. Adaptable to a wide range of uses for large and small utilities — REA's, contractors, telephone, water departments. Send for catalog.

**MODEL B6:** For mounting on any ½ ton truck chassis with CA dimension of approximately 38 inches. 15 separate compartments—light—compact — attractive.

**MODEL B7:** For mounting on any ¾ to 1 ton truck chassis with CA dimension ranging 48 inches to 60 inches. 26 separate compartments. Sturdy — compact — practical.

FWD

Distributed by GRAYBAR

**EAGLE MANUFACTURING CO.**

Division of the Four Wheel Drive Auto Co.

APPLETON WISCONSIN

Write today for the complete catalog of FWD Line Construction and Maintenance Equipment — a useful reference book.

***INSULATED* to withstand continuous temperature of**

356° F.
Conductor: Copper wire
Conductor insulation: Silicone Mica-Glas Tape
Ground insulation: Silicone Mica-Glas Tape
Ground insulation: Silicone Mica-Glas Wrapper
Outside tape: Silicone Fiberglas Tape
Finish. Silicone Varnish Used Exclusively

**National's Silicone electrical insulating materials meet AIEE Class H specs. They boost the Class B 266° F. continuous operation maximum to 356° F. They include tapes, tubings, varnishes, cloths, sheets, adhesives and laminates. National Silicone Mica-Glas Tape is made just .0035" thick. All National Class H components have high dielectric strength, high flexibility, long life; they contain practically NO organic materials. Send for our Insulation Catalog No. 494.**

**NATIONAL ELECTRIC COIL COMPANY**

COLUMBUS 16, OHIO, U. S. A.

ELECTRICAL ENGINEERS MAKERS OF ELECTRICAL COILS AND INSULATION — REBUILDING AND REPAIRING OF ROTATING ELECTRICAL MACHINES


Lane succeeds **Thomas L. Spooner,** who retired in August after 40 years of service. Mr MacLane joined Westinghouse in 1936 after several years' association with the Central Arizona Light & Power Co.

**Dr Arpad Nadai,** consulting mechanical engineer for the research laboratories and a specialist in the plastic flow of metals, has retired after more than 35 years' service in this field. Dr Nadai has won wide recognition for his research in the field of mechanical properties of metals, plastic flow, and strength of materials.

## Burd Made Vice-President of Ansonia Electrical

Harry G. Burd has been elected a vice-president of the Ansonia Electrical Co, Ansonia, Conn. Mr Burd has long been identified with the development of new products in the electrical wire and cable industry.

HARRY G. BURD

Mr Burd has been associated with the Standard Underground Cable Co, the National Conduit & Cable Co, and since 1930 with the Anaconda Wire & Cable Co.

His past responsibilities have embraced engineering, cost determination, selling, and executive activities.

## OBITUARY

**Max A. Pooler,** formerly president of the Tucson Gas, Electric Light & Power Co, Tucson, Ariz., died on Sept 16 at San Diego, Calif., at the age of 69. Born in Austin, Minn., Mr Pooler went to Tucson in 1926 as vice-president and general manager of the power company. He relinquished the presidency in 1946.

**H. Parker Weeks,** assistant to the president of the Iowa-Illinois Gas & Electric Co, Rock Island, Ill., died suddenly on Sept 12. Mr Weeks had been identified with the company and predecessor com-

# MALLORY

## ELKONITE* CONTACTS

### Help Guard the Rural Dweller's "Life-Line"

A slim strand of wire brings city living to the farm. But interrupt that service and you plunge back a hundred years. Lights fail, water stops running, precious milk spoils. The automatic recloser guards this service by eliminating unnecessary power stoppages. This modern device assures more continuous electrical service to rural and suburban America.

And, of course, you'll find tough, and dependable Mallory Elkonite Contacts at work here, as you will wherever dependability and long life are vital. Mallory Elkonite Contacts are precision-made—have the required toughness, resistance to both wear and erosion that demanding applications need. That's because Mallory exercises the most rigid processing control of materials.

***What's Your Problem?***

Wherever dependability and long life are "musts" you'll find Mallory Contacts specified. In circuit interrupters at Grand Coulee—in refrigerators—in street lighting systems—in lift trucks—in automobiles. And Mallory has designed so many types there is probably a standard Mallory Contact for your needs. But if your particular product should call for a "special", Mallory engineers are ready and able to supply it. Consult them now.

*For all kinds of contact materials and service, Mallory is your most dependable and experienced source.*

*In Canada, made and sold by Johnson Matthey & Mallory, Ltd. 110 Industry St., Toronto 15, Ontario*

Electrical Contacts and Contact Assemblies

P. R. MALLORY & CO. Inc.

MALLORY

P. R. MALLORY & CO., Inc., INDIANAPOLIS 6, INDIANA

**SERVING INDUSTRY WITH**

Capacitors — Rectifiers
Contacts — Switches
Controls — Vibrators
Power Supplies
Resistance Welding Materials

*Reg. U. S. Pat. Off.

MOSINEE doesn't count its success in terms of big volume records. More important to us is the aid that MOSINEE "paperologists" and facilities provide our customers.

If you have a problem involving paper . . . if you require specific technical characteristics such as high tensile or tear strength, accurate caliper, density, liquid repellency or absorbency, good dielectric strength, specified pH for maximum-minimum acidity or alkalinity . . . and above all, if you want to be sure of *dependable uniformity* . . . it will pay you to specify "MOSINEE." For consultation with MOSINEE technicians, without obligation to you, please write Dept. FW.

MOSINEE

*"More than Paper"*

MOSINEE PAPER MILLS COMPANY • MOSINEE, WISCONSIN

*"Essential Paper Manufacturers"*

panies for some 27 years. He started as advertising manager of the United Light & Railways Service Co. He was then made sales supervisor of the Peoples Power Co, serving in that capacity until 1942, when he was named Illinois district manager for the newly formed Iowa-Illinois Gas & Electric Co. In 1947 he was selected to fill the position of Quad-Cities Zone manager and was made assistant to the president in May of this year.

**Joseph D. Cotton,** vice-president and director of the Four Wheel Drive Auto Co, Clintonville, Wis., died suddenly at his home in that city on Sept 23. He was 76 years old. Mr Cotton had purchased stock when the company was first organized and in 1915 became its advertising manager. In 1919 he was made the first president of FWD's subsidiary in Canada, Four Wheel Drive Auto Co, Ltd. He was named vice-president of the parent company in 1920. From 1934 to 1939 he was manager of FWD's Chicago branch, and, returning to Clintonville in 1941, he was named director of labor and public relations. He retired from active work with the company three years ago but continued as a director and vice-president.

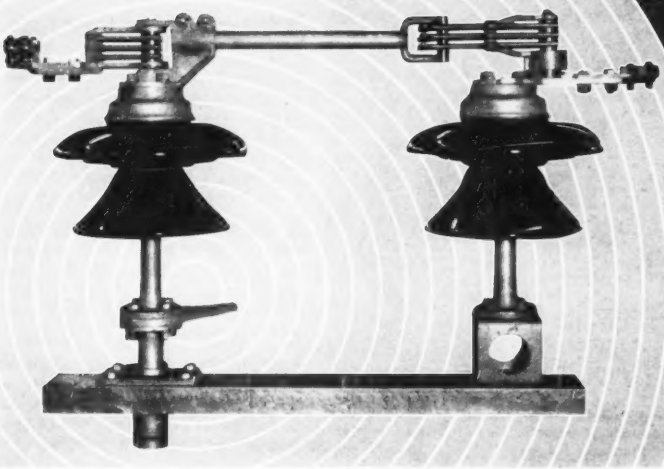
**P. J. Montgomery,** veteran of 39 years' service with the Northern States Power Co, Minneapolis, died in that city on Aug 8 after an illness of two years. He was 61 years old. Mr Montgomery was born at Minto, N. D. At the time of his death he was sales engineer in Minneapolis. He obtained his early experience with the Minneapolis General Electric Co and the Wisconsin-Minnesota Light & Power Co. From 1924-34 he served as manager of the Grand Forks division of the Northern States Power Co, in 1937 being transferred to Minneapolis as sales engineer.

**Arthur Palme,** a power transformer engineer with the General Electric Co, Pittsfield, Mass., died in that city on Sept 26 at the age of 64. Mr Palme was born in Austria and was graduated as an electrical engineer from the University of Vienna. He had been with GE since 1913. Mr Palme reviewed foreign literature some few years ago for ELECTRICAL WORLD, when this publication carried digests of foreign literature.

**Howard J. Glasgow,** 48, La Mesa, Calif., district manager for San Diego Gas & Electric Co, died of a heart attack Sept 20. Mr Glasgow was employed by the utility company in 1923. He worked in the San Diego office order department for six years, later was district agent in National City, and then was transferred to La Mesa.

# 3 PLUS VALUES OF

# ROYAL Type RLL SWITCHES



* 1 SIMPLICITY OF DESIGN

2 HIGH PRESSURE POINT CONTACTS

3 SEALED BALL BEARINGS

•

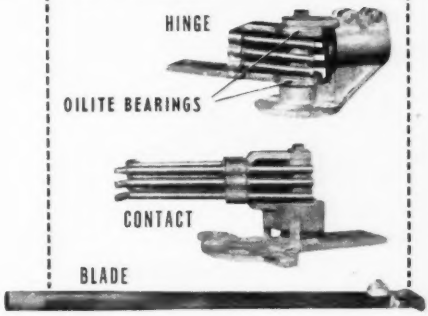
## * SIMPLICITY OF DESIGN:

If there is anything to theory and past experience then, the simpler you make a piece of switching equipment, the greater its dependability. In the type RLL side break switch, Royal engineers have reduced the number of subassemblies to three.

The operation of the switch is simplicity itself. By using high pressure point contacts at both hinge and contact ends of the switch, braid jumpers (and the deterioration which develops in them) have been eliminated. Contact is made by a wiping action of the blade's cam in expanding the contact rods when the blade swings into closed position. It is simple, positive and firm. The rolling action breaks ice and corrosion without the complicated "broken-back" type of mechanism. The contact is held in position to receive the blade cam by a beryllium—copper motor spring.

Corrosion in the hinge bearing points—always a potential source of trouble—is eliminated by "Oilite" bearings. There is only one bolted connection in the electrical path of the switch (it is silver-plated). The adaptors used under all Royal rotating insulator switches have bearing holes to make for easy installation of a grounding switch interphase shaft. Built in all voltages up to 196 KV, and in current ratings from 400 to 1200 amps. For complete data write for a copy of Royal's Catalog No. 11.

## ONLY THREE SUB ASSEMBLIES




35 YEARS
*A Part of the Arsenal of*
AMERICAN POWER PRODUCTION

**Royal ELECTRIC MANUFACTURING COMPANY** INCORPORATED

1122 EAST 87th STREET *Chicago 19, Ill.*

*Designers and Manufacturers of Power Switching Equipment and Special Electrical Devices*

# MANUFACTURERS and MARKETS

**ARMORED CAR GUARDS** deliver 20,000 silver dollars to the plant of the Duro Test Corp at North Bergen, N. J. The money will be distributed to purchasers and salesmen of a new type starter used as auxiliary equipment in fluorescent lighting

## Duro Test Corp Will Hold Its Silver Anniversary

Duro Test Corp, North Bergen, N. J., is making use of a novel promotion idea to spark the sales of a new product now being introduced to mark its silver anniversary in 1950.

A special offer is being made which pays off in real silver dollars and in which both the purchaser and Duro Test salesmen participate. The product is a new type "starter," which is used as auxiliary equipment in fluorescent lighting. To stimulate quick interest, purchasers of 75 starters receive a special discount of 17 silver dollars and the salesman earns a bonus of one silver dollar for every such sale.

The idea of paying off in silver dollars has proved to be a popular incentive to the buyer and also compensates the salesman for the extra time required to introduce this new product. It also ties in successfully with Duro Test's silver anniversary.

Walter Simson, Duro Test president, states that he considers this promotion one of the most successful ever conducted by the company. It is proving to be a real sales builder and is being enthusiastically received by the customers and the salesmen like it, too.

•

## Atomic Power Test Plant Contract is Let in NY

The Thomson Construction Co of Albany, N. Y., has been awarded a $560,311 contract for building first units of an experimental atomic power plant at West Milton in Saratoga County. General Electric Co will operate the plant for the Atomic Energy Commission.

James C. Stewart, AEC manager of operations in Schenectady, said the contract provides for construction of an administration building, fire station, maintenance shops, and preparation of grounds. Work is to be completed early next April, Mr Stewart said.

The AEC expects this new laboratory to be the first to produce significant amounts of useful power from atomic energy. The laboratory, which is to be erected on a 1,000-acre tract, will be part of the Knolls Atomic Power Laboratory, which GE operates for AEC.

## MANUFACTURING BRIEFS

**Baldwin** Locomotive Works, Philadelphia, has received an order from the U. S. Army Engineers, Bismarck, N. D., for three 88,000-hp hydraulic turbines for installation at Garrison Dam, located on the Missouri River. The installation is part of the Missouri Valley Development. Total price for the three turbines, including spare parts, amounts to approximately $2,640,000.

**Available for sale** or lease, is the Piqua (Ohio) plant of Robbins & Myers, Inc. All operations at Piqua will be moved to Springfield, where sufficient facilities are now available to carry on the company's operations.

**A regular schedule** of color television programs has been inaugurated in Washington, D. C., by the Radio Corp of America to demonstrate its new system of high-definition, all-electronic color television during hearings on color television now under way before the FCC. Development of this system enables FCC to lift the television "freeze" immediately and allocate ultra-high frequency channels, with provision for color service on these same channels used in black-and-white television transmission, Dr E. W. Engstrom, vice-president in charge of research, RCA Laboratories, declared.

**Pennsylvania Transformer Co.**, Pittsburgh, has announced that the sales and advertising departments have moved to new offices at the Pennsylvania plant in Canonsburg, Pa., effective Oct 3. The Pittsburgh district sales office, under the direction of Rush F. Young, Pittsburgh district sales manager, will remain at 808 Ridge Ave, North Side, Pittsburgh.

**Directors** of McGraw Electric Co, Chicago, have approved the merger of the Line Material Co, Milwaukee, into McGraw Electric. The merger will become effective within the next two weeks. Under the terms of the merger, each share of the capital stock of Line Material will be exchangeable for two-thirds of a share of McGraw Electric common. Stockholders of Line Material

## In Plant After Plant—

# One of America's Largest Auto Manufacturers Has Selected MULTICLONES for Fly Ash Recovery!

**Over 35 MULTICLONE Units To Date in Various Plant Divisions!**

### A Few of *Many* MULTICLONE Advantages!

#### POINT 1 —It Saves Space!

Plant space costs money. Because the Multiclone makes *really important* savings in space, it makes similar savings in plant costs. The chart tells only part of the story because, in addition to being far more compact both in square and cubic footage, the *shape* of the Multiclone can be adjusted to fit various space requirements—either long and narrow, short and wide, or square. You can often fit the Multiclone into tight spaces or waste areas too small for other equipment!

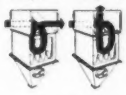
| Make | Relative Space Requirements In Sq. Ft. | In Cu. Ft. |
|---|---|---|
| Multiclone | 1.0 | 1.0 |
| Collector A | 2.1 | 1.8 |
| Collector B | 5.9 | 3.2 |
| Collector C | 6.8 | 3.9 |

#### POINT 2 —It Recovers the "Fines"!

Because its exclusive vane design and small diameter tubes generate higher centrifugal forces, the Multiclone recovers a large percentage of even the very fine particles 10 microns and less as well as the heavier particles. Multiclone's high recovery of both small and large particles means high overall collecting efficiency.

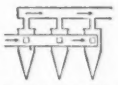
#### POINT 3 —It is Unusually Adaptable!

In addition to the shape adaptability outlined above, Multiclone's inlet-outlet connections are also readily adaptable to plant restrictions. Where headroom is low, install the Multiclone with side-inlet, side-outlet. Where side clearances are small, use side-inlet, top-outlet arrangement. Or still other arrangements are possible!

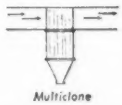


#### POINT 4 —It is Simple!

Both installation and maintenance of the Multiclone are unusually simple. For example, the Multiclone requires only a *single* inlet and a *single* outlet duct compared with the complicated multiple ducts of conventional cyclones. This not only saves space—but is simpler and cheaper to install and insulate. Moreover, the Multiclone has no filters to replace, no high-speed moving parts to maintain, nothing to require frequent cleaning or repair . . . and a *single* collecting hopper serves many tubes!



*Conventional Cyclone*



*Multiclone*

#### POINT 5 —Still Other Advantages!

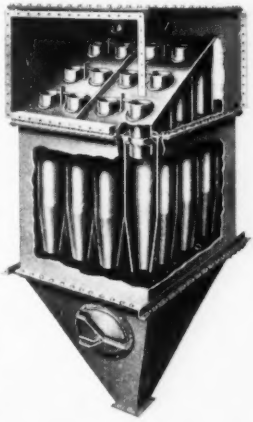
The above advantages are by no means the complete story on Multiclone savings. Get *all* the facts before you decide on any recovery installation.

**Send for this Multiclone booklet!**

COTTRELL PRECIPITATORS · MULTICLONE COLLECTORS · TURBULAIRE SPRAY DRYERS

YEAR AFTER YEAR—in plant after plant—one of the nation's largest automobile manufacturers has selected Multiclone Collectors for recovering fly ash and dust in its many manufacturing divisions. This repeated selection of Multiclones—now totalling over 35 units—is high testimony to the many vital advantages found in Multiclone equipment. Check over some of these advantages as outlined at left . . . advantages that will save space—cut installation costs—boost recovery efficiencies—minimize maintenance and make other important savings on *your* recovery operations, too.

Then consider this fact . . . Any *one* of these advantages is sufficiently important in itself to make Multiclone equipment the logical choice for your recovery operations. But when you realize that the Multiclone offers definite, clear-cut advantages on *every* qualification essential to maximum efficiency and economy in recovery operations you have some idea of the far-reaching savings you will make by installing Multiclone.



Let us give you further information on Multiclone recovery equipment. A letter, wire or phone call to our nearest office places the information in your hands without obligation. Get *all* the facts—and you'll get Multiclone!

**WESTERN Precipitation CORPORATION**

ENGINEERS, DESIGNERS & MANUFACTURERS OF EQUIPMENT FOR COLLECTION OF SUSPENDED MATERIALS FROM GASES & LIQUIDS

*Main Offices:* 1004 WEST NINTH STREET, LOS ANGELES 15, CALIFORNIA
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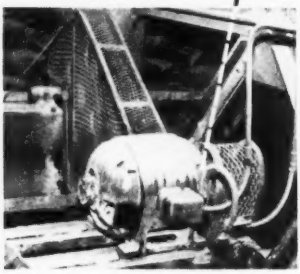
Silicone News

DC SILICONES

Here's where DC Silicone Insulation Saved $700 per hour



It cost Standard Gypsum Company of California about $700 per hour every time heavy overloads caused the 25 h.p. motor driving screw conveyors in the mixing house to fail. And such expensive motor failures were occurring every 30 to 60 days until the silicone insulated 10 h.p. motor shown above was installed in December, 1948.

This silicone insulated motor is only about ½ the size and weight of the motor formerly used, yet, it is still performing the same work after 8 months without failure. That's what is meant when we say Dow Corning Silicone Electrical Insulation gives you more power per pound, greater reliability, reduced maintenance costs and increased production.

Every day, more and more engineers are specifying DC Silicone Electrical Insulation in motors exposed to excessive heat, moisture, or heavy overloads. If you would like to learn why these engineers are relying on Silicone Insulation, phone our nearest branch office or write for booklet P-10

DOW CORNING CORPORATION
MIDLAND, MICHIGAN

Atlanta • Chicago • Cleveland • Dallas
Los Angeles • New York
In Canada: Fiberglas Canada, Ltd., Toronto
In England: Albright and Wilson, Ltd., London

Photo courtesy Standard Gypsum Company of California

FIRST in Silicones

ow orning

will receive two-thirds of the current McGraw Electric dividend. McGraw this week declared a dividend of $1.25, making the total payable to Line Material stockholders 83½¢.

**General Electric Lighting Institute** at Nela Park, Cleveland, Ohio, has issued its semi-annual bulletin, "Scheduled Courses and Conferences," for the fall period. The courses are particularly planned for agents, distributors, and large consumers of General Electric lamps, and for architects, consulting engineers, and teachers of home economics, illumination, and allied courses in schools, colleges, and universities. These programs are scaled in difficulty and content to suit the needs of the particular group for which they are planned.

**Establishment** of the Westinghouse Graduate Fellowship in power systems engineering at Texas A&M College has been announced. The fellowship is provided by a grant from the Westinghouse Educational Foundation of Pittsburgh, Pa. Purpose of the fellowship is to encourage and promote the study of advanced fundamentals in power system engineering.

•

## Manufacturers Make New Sales Assignments

Electrical manufacturing companies have recently made the following appointments to their sales staffs:

**Oliver Iron & Steel Corp,** Pittsburgh, has appointed K. D. Busbee southwestern district representative, with headquarters at Dallas. He will report to the corporation's southern sales headquarters at Birmingham, Ala.

**General Electric's** Lamp Department has established three new sales districts: Connecticut Valley, New Haven, Elbert A. Hawkins manager; Texas Gulf, Houston, George S. Trotter manager; Puget Sound, Seattle, Lloyd R. Wilson manager. Mr Wilson, who has been manager of the North Pacific Sales district, Portland, will be succeeded in that position by Walter J. Pitblado, formerly manager of the Portland service district.

**Cannon Electric Development Co.** Los Angeles, has appointed the Harris-Hanson Co of St. Louis, Mo., to represent it in the central and eastern portions of Missouri and central and southern Illinois, with headquarters at 208 North 22d St, St. Louis 3, Mo.

**Marcus Transformer Co, Inc,** Hillside, N. J., has appointed the Edward K. Meyer Co, 714 Sixteenth Ave, S.E., Minneapolis 14, Minn., as its representative.

**General Switch Corp,** Brooklyn, N. Y., has appointed the Thomas W. Bullock Co, Louisville, Ky., sales agent. Bullock will cover southern Ohio, Kentucky, the southern portion of West Virginia, and western Tennessee.

Make HARPER YOUR SINGLE SOURCE for NON-FERROUS AND STAINLESS STEEL Fastenings

BRASS • BRONZES • COPPER • MONEL • STAINLESS STEEL

**Only HARPER** carries large stocks of **6,000 DIFFERENT ITEMS** in from **3 to 10 DIFFERENT METALS!** the widest assortment of bolts, nuts, screws, washers, rivets and accessories **available from ONE SOURCE.**

**Convenient Warehouse Service** for prompt delivery to any point in the country.

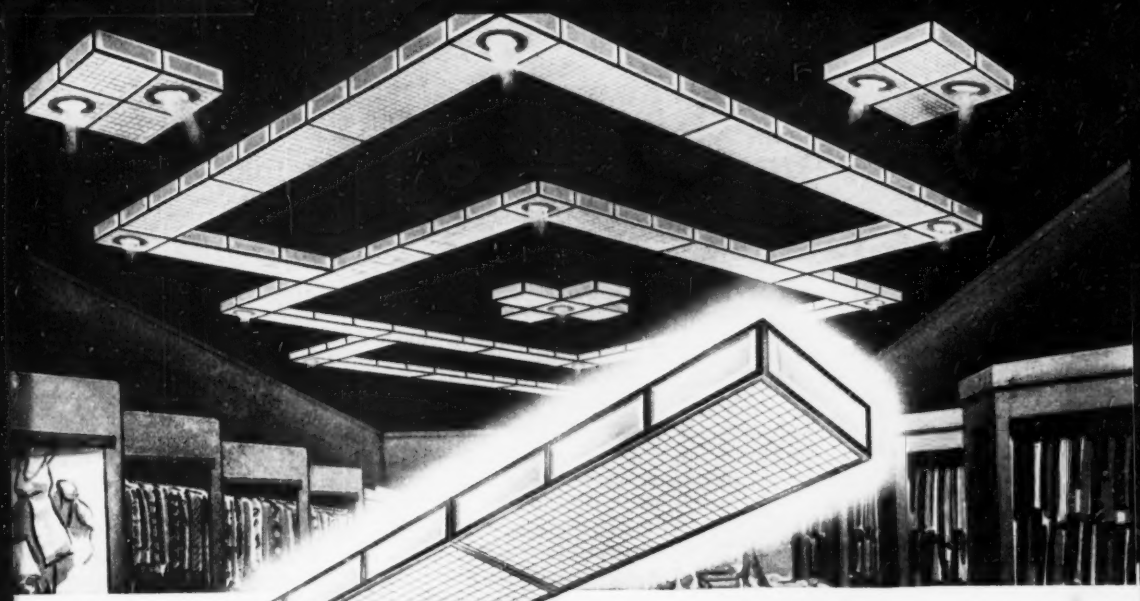
Wire or phone your requirements to the nearest Branch Office. Complete 134-page color catalog sent upon request.

THE H. M. HARPER COMPANY
**General Offices and Plant: Morton Grove, Illinois**
(Suburb of Chicago)

**New York Office and Warehouse:** 200 Hudson Street, New York 13, **Los Angeles Office and Warehouse:** 835 E. 31st Street, Los Angeles 11. **Branch Offices:** Atlanta, Cambridge, Cincinnati, Cleveland, Dallas, Denver, Detroit, Grand Rapids, Milwaukee, Oakland, Philadelphia, Pittsburgh, St. Louis, Seattle, Toronto (Canada).

HARPER

EVERLASTING FASTENINGS



MITCHELL

# module

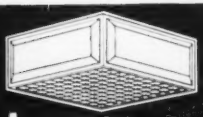
REG U S PAT OFFICE

## Revolutionizes Commercial Lighting Installations!

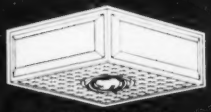
### For the First Time! All the Advantages of the Finest Custom-Fitted Installations Using Low Cost, Simply Installed Stock Units!

It's amazing! See what these 4 simple, low-cost "building blocks of light" accomplish *for the first time!* Custom-fitting MITCHELL MODULE makes possible unlimited 90° lighting patterns, fits any ceiling regardless of shape or size, mixes all light sources in one harmonious system, provides equal low brightness throughout. MODULE *really* puts the light where it's needed—is recognized and acclaimed by leading authorities as truly *superior* lighting. There's never been anything like it before. For full details, write today.

***Only MITCHELL makes MODULE***

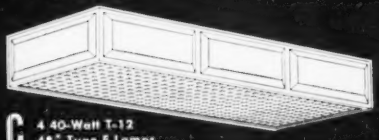


**A** 4 14-Watt T-12 15" Type F Lamps

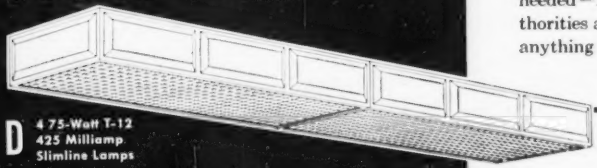


**B** 1 32-Watt 12" Circline Lamp, & 1 PAR Spot or Flood Lamp

these 4 modules are the "building blocks" of the Mitchell Module Lighting System



**C** 4 40-Watt T-12 48" Type F Lamps



**D** 4 75-Watt T-12 425 Milliamp Slimline Lamps

Write today for the free 20-page MODULE brochure which gives every detail of this revolutionary new lighting development. Use coupon at right.

**MITCHELL MANUFACTURING COMPANY**
**2525 N. CLYBOURN AVE., CHICAGO 14, ILLINOIS**

Send full details on MITCHELL MODULE.

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Attention:_____

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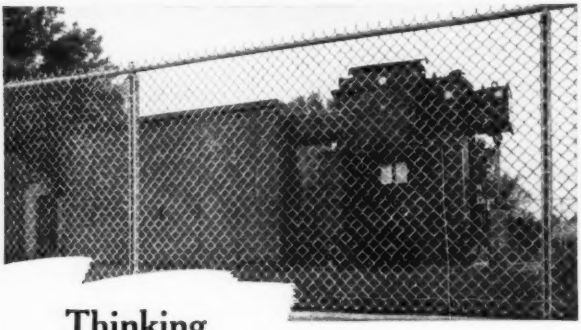
• AMERICA'S FIRST WIRE FENCE •



## Thinking about a Fence?

• You know that protection is good judgment—and you intend to do something about it. To know *what* to do, write for illustrated facts. Note the several styles of Page Chain Link Fence and Gates. Then talk with our nearest association member. He will help you pick the *right* fence, made of the right metal in the right way, and will explain his right method of fence erecting. He is an experienced local fence specialist offering more than a product—a complete fence service. His name will be sent to you with fence facts we offer.

***Write** to PAGE FENCE ASSOCIATION in Monessen, Pa., Atlanta, Bridgeport, Chicago, Denver, Detroit, Los Angeles, Philadelphia, Pittsburgh, New York or San Francisco.*

**PRODUCT OF PAGE STEEL & WIRE DIVISION OF AMERICAN CHAIN & CABLE COMPANY, INC.**

# SLASH OPERATING COSTS... with Tel-E-Lect POLE LINE EQUIPMENT

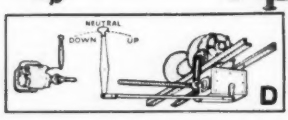
**For installation on your present truck—or on new equipment**

**A POLE HOLE DIGGER** . . . Uses your regular derrick and crew. Attaches by a single bolt to power take-off shaft. Adjustable for clean holes up to 10 feet deep. Interchangeable augers 8 to 20 inches diameter.

**B DERRICKS** . . . Both "A" frame and "T" type for front or rear mounting on all makes of trucks.

**C UTILITY CABINETS AND MATERIAL RACKS** . . . Bolts onto any flat bed truck. Gives needed facilities for pole line work at a fraction of the cost of a utility body.

**D WINCH DRIVE BOX** . . . Gives instant forward and reverse action to your winch. Permits operator to give all his attention to the winch job and speeds up work. *Easy to operate:* Simply engage power take-off just once. No further shifting to PTO or use of truck clutch required. Just move a single cab lever forward or backward to lower or raise the winch line. Available for single or double drum winches.




**For literature or demonstration, write to**

**TEL-E-LECT PRODUCTS, INC.**

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# NEW ELECTRICAL CONSTRUCTION

**NEW ELECTRICAL construction projects announced by private and government utility systems involving more than $70,000. Also listed are major industrial and construction jobs where electrical work is included**

## UTILITIES

### *Proposed Construction*

**Alabama**—Dixie Electric Co-operative, Union Springs, 130 mi. rural distr. line and sys. imprvs., Bullock Co. **$305,000.**

**Illinois**—Wayne-White Counties Electric Co-operative, Fairfield, 252.5 mi. rural distr. lines, 34 mi. 34.5 KV transmission lines, sys. imprvs.; Wayne Co. **$1,017,000.**

**Ind., Angola**—Merle Tucker, dist. mgr., Northern Indiana Public Service Co., Angola, sub-station, dist. headquarters, northwest section, incl. engineering dpt. testing rooms, storage rooms, crew headquarters, lockers, service rooms, offices, 41x42 ft. and 49x50 ft. garages, transfer of transformer banks and 175 foot two-way broadcasting tower and sys. to new site, increase feed lines, from generating plant at Michigan City to Angola from 33,000 to 66,000 volts.

**Massachusetts, Connecticut and Rhode Island**—Northeastern Gas Transmission Co., Alex Macomber, chn., 317 Marlboro St., Boston, Mass., 500 mi. gas transmission lines, Greenwich, Conn., Northampton, Fitchburg, Lawrence, Haverhill, New Bedford, Mass., and Providence, R. I., etc. **$17,000,000.** Tennessee Gas Transmission Co., 1006 Main St., Houston, Tex., consult. engrs.

**Montana**—U. S. Eng., Fort Peck, installing electrical light and power cables in service tunnel and electrical ducts in Shaft Area; install 100 hp. air compressor, air tank auxiliaries and associated electrical control eqrip. Main Control Shaft Bldg. 1; install underground and overhead signal and communication cables between Shaft Area and Power House; install gate position indicating equip. and lake water level recording sys., in Shaft Substation, Main and Emergency Control Shaft Bldgs., and Power House, Fort Peck, Serial No. CIVENG 24-016-50-16.

**Nebraska**—U. S. Eng., 1709 Jackson St., Omaha, Zone 2, construct power lines to pumping stations for Omaha Flood Protection Projects, Douglas Co., CIVENG-25-066-50-69.

**O., Cleveland**—Hubbel & Benes, archts., 4500 Euclid Ave., 2 story, 40x50 ft., brick radio station addn. and alterations, convert present bldg. into 7 broadcasting studios, 2 television studios, 2 story addn., 21 dressing rooms, parking lot, etc., for Radio Station WHK, c/o **H. K. Carpenter**, 1131 Terminal Tower. **$360,000.** Plans deposit $10.

**Oregon**—Clearing Right-of-Way, Bonneville Power Admin., 729 N. E. Oregon St., Portland, clear 12.7 mi. right-of-way for Eugene-Goshen No. 1 and 2, 115 kv. transmission lines, Inv. 4831, Lane Co. Plans deposit $5.

**South Dakota**—Rosebud Electric Assn. Winner, approx. 2-7 mi. rural distr. lines, Gregory Co. **$300,000.** Plans deposit $25. United Engr. Service, 600 Kasota Bldg., Minneapolis, Minn., engr.

**Wyo., Cheyenne**—Cheyenne Light, Fuel & Power Co., Cheyenne, sub-stations, exten. gas mains, various new equip. feeder line, re-build pole lines, new conduit, etc., **$466,890.**

### *Low Bidders & Contracts Awarded*

**Ill., Quincy**—State Div. Architecture & Eng. Capitol Bldg., Springfield, two 500 KW turbine generating units, Soldiers & Sailors Home, to Worthington Pump & Mchy. Corp., Harrison, N. J. **$80,550.** Bids 8-23, awarded 9/22.

**Minnesota**—East Central Electric Assn., Braham, Sept. 20, furnish materials, install about 266 mi. rural distr. lines in Benton, Morrison, Mille Lacs, Kanabec, Isanti, Pine and Chisago Counties. (Minnesota IT Kanabec), from Hallett Constr. Co., Crosby, **$310,768.**

**Missouri**—Citizens Electric Corp., Ste.

HANDY ANDY SAYS:

# When you have to plug it... plug it up with

## Johns-Manville DUXSEAL

**DUXSEAL**—the plastic plugger-upper—can do more work for you with less effort than almost anything you can name. Work-conscious electricians have taken advantage of the effortless application characteristics of Duxseal for years . . . to plug up openings around service boxes, cable entrances, conduit ends . . . to fill up small holes in foundations.

**Remains soft**—Duxseal stays soft indefinitely, but will not slump, melt or run under ordinary temperatures.

**Remains tight**—Clings to duct walls and cables but gives with expansion or contraction of the cable.

**Remains insoluble**—Unaffected by ground waters and gases.

**Remains harmless**—Will not injure workmen's hands or react with rubber, metals or painted surfaces.

**Tight seals for other electrical uses:**

**J-M Tranolseal** . . . for use with electrical equipment using dielectric oils.

**J-M Uniseal** . . . for caulking against weather and humidity. Resists temperatures up to 180 F.

If you would like to know more about Duxseal and these other labor-saving sealing compounds, write Johns-Manville, Box 290, New York 16, N. Y.

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**SEALING COMPOUNDS**

# Snap-on's FAMOUS Ferret Set

**Rugged tools . . . . twice as strong as you would expect such slim, streamlined handles and thin-walled sockets to be.**

*"The Choice of Better Mechanics"*

Mechanics like this set because it is way over par in performance . . . the tools are strong and easily adaptable to a variety of jobs.

They squeeze into tight places and get those hard-to-reach nuts and bolts that defy the ordinary type wrench. Recently designed by Snap-on engineers, they have the new features that make fast, easy work of the tough jobs.

**INCLUDED IN THE SET:** 1/4" and 5/16" single broached sockets; 11 double broached sockets from 3/8" to 7/8"; a speeder wrench, sliding tee, 8" reversible ratchet, nut spinner and universal joint, plus a 3", 6" and 12" extension. All complete in a metal box for only . . . . . **$27.65**

## Present Owners

***Supplement your present set with these special Ferret tools . . . . .***

**CLUTCH-TYPE SCREW DRIVER**
Handles clutch - type (figure 8) head screws. Built short for easy operation in close quarters.

**RATCHET ADAPTOR**
Converts any combination of Ferret handle, extension and socket into a reverse action ratcheting tool.

**PLASTIC GRIP HANDLE**
A shockproof, plastic handle, 5¼" long that is ideal for electric work. Makes your Ferret Set more useful.

**DOUBLE HEX FLEXOCKETS**
Saves a lot of tough work fumbling for hard to get at studs and bolts. Eight sizes: 5/16" to 3/4".

**FERRET FLEXTENSION**
A flexible steel cable extension connects handle and socket to work around corners and over obstructions.

**EXTRA LONG FERRET SPEEDER**
36½" long, 27" shank. Radius of sweep is 3½". "Palm-Grip" handle rotates to provide easy operation.

**SNAP-ON TOOLS CORPORATION • 8108-I 28th Ave., Kenosha, Wis.**

Enclosed find ☐ check ☐ Money order or

☐ Company Purchase Order for the $27.65 Snap-on Ferret Set.

☐ Please send illustrated brochure describing 109 individual Ferret units.

Name.....

Address.....

City.....State.....

TIGHT CONNECTIONS assured by using PALNUT TRADE MARK SELF-LOCKING NUTS

• The Railway & Industrial Engineering Co. overlooks no details to insure years of satisfactory service from its products. An example is the use of PALNUTS to assure permanently tight nut-and-bolt assemblies on its line of fittings, switches, clamps, cutouts and other R. & I. E. equipment.

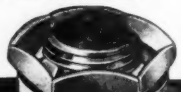
TIGHT connections are vital in the distribution and transmission of Power. That's why you see PALNUTS on wood pole lines, steel transmission towers, bus fittings, connectors, switchboards, terminals, substations and other electrical equipment.

PALNUTS apply quickly on top of regular nuts, holding them to original tightness under severe vibration. No check-ups or re-tightening are required. On electrical connections, perfect conductivity is maintained. PALNUTS are available in a wide range of sizes in plain spring tempered steel; also hot-dip galvanized and silicon bronze for weather resistance.

Send details of your needs for samples. Write for literature on entire line.

THE PALNUT CO.

51 Cordier St., Irvington 11, N. J.



DOUBLE-LOCKING PALNUTS

Trademark Reg. U. S. Pat. Off.


Genevieve, 241.22 mi. rural distr. lines, Ste. Genevieve Co. to W. S. Young Co., Shreveport, La., **$155,050.** Drazen & Assoc., 8135 Forsyth Blvd., Clayton, St. Louis, Zone 24, consult. engrs.

**Montana**—Bureau Reclamation, Dpt. Interior, Columbia Falls, Sept. 20, clearing part of Hungry Horse Reservoir site, Hungry Horse Proj., 25 to 45 mi. southeast of Columbia Falls, on Spotted Bear Rd., Spec. R1-HH10, from Nello L. Teer Co., Durham, N. C., **$6,715,100.**

**Ohio**—Belmont Electric Co-operative, Inc., Harry McAllister, mgr., St. Clairsville, July 22, 72 mi. rural distr. lines, incl. conversion, removal, new tie-lines, in Belmont and Monroe Counties, Proj. Ohio 321 Belmont, Sect. 2, from Wolfrey Electric Co., Inc., 2119 Cleveland Ave., Columbus, **$110,307.**

**Oregon**—Bonneville Power Admin., 729 N. E. Oregon St., Portland, Sept. 22, clearing 44.6 mi. right-of-way for Warm Springs sect. Maupin-Detroit 230 kv transmission line, Inv. 4817, Wasco Co., from W. D. Zavalas, Oroville, Calif., **$109,340.**

**Tennessee**—Greeneville Light & Power Co., Greenville, 300 mi. rural distr. lines and imprvs., Greene Co., to Townsend Electric Co., Jackson, **$713,511.**

## INDUSTRIAL, COMMERCIAL & PUBLIC BUILDINGS

### *Proposed Construction*

**Ill., Chicago**—Meyer J. Hatowski, Morris Grenberg & Joseph R. Shapiro, Marine Dr. between Margate and Argyle Sts., Zone 40, plans by Dubin & Dubin, 127 N. Dearborn St., Zone 2, 14 story, steel, concrete, brick, stone apartment, incl. 516 units, **$5,600,000.**

**Mass., Taunton**—Commonwealth of Massachusetts, Dpt Mental Health, 100 Nashua St., Boston, plans by Leland & Larsen, 814 Statler Bldg., Boston, hospital group, State School at Camp Myles Standish, incl. tunnels, power house, dormitories and cafeteria, service bldgs. utilities and nurses home, **$8,700,000.** R. D. Kimball Co., 6 Beacon St., Boston, engr.

**O., University Heights**—John Carroll University, Rev. Frederick E. Welfe, S.J., pres., University Heights, 3 story, bsmnt., men's dormitory, **$713,000;** similar dormitory, physics b'dg., school of business bldg., student union bldg., gymnasium and swimming pool, stadium, military training quarters; power plant addn. Approx. **$6,000,000.**

**Pa., Pittsburgh**—U. S. Eng., 925 New Federal Bldg., Zone 19, buildings, passageways and utilities on site of Veterans Admin. Neuropsychiatric Hospital, CIVENG-36-058-50-18, for Veterans Admin., Vermont Ave. between H and I Sts. N.W., Wash. 25, D. C. $12,000,000-$16,000,000.

**Pa., Pittsburgh**—Equitable Life Assurance Society, 393 Seventh Ave., New York 1, N.Y., "Gateway Center", three 20 story office bldgs. on 23 acre site at junction of Alleghany and Monongahela Rivers, **$50,000,000.** (Construction probably will be done by Starrett Bros. & Eken, 63 Wall St., New York 5, N. Y., but no contract signed to date.)

**Tex., Dallas**—National Industries, Inc., Republic Bank Bldg., 10 story merchandise mart, Young and Austin Sts. **$7,500,000.**

### *Low Bidders & Contracts Awarded*

**Ala., Birmingham**—U. S. Eng., P. O. Box 1169, Mobile, Zone 7, 500 bed general medical veterans administration hospital, Serial No. CIVENG-01-076-59-13, to Thompson & Street Co., 72 11 St. N. E., Atlanta, Ga., **$5,887,000.** Bids 9/8, awarded 9/28.

**Ill., Decatur**—A. E. Staley Mfg. Co., E. K. Scheiter, exec. vice pres., Decatur, general contract plant and preparatory bldg. addn., to H. K. Ferguson Co., Hanna Bldg., Cleveland, O. Approx. **$2,500,000.** Blaw-Knox Constr. Co., Chemical Plans Div., 321 Pennsylvania Ave., Pittsburgh, Pa., engrs.

**Nev., Reno**—Reno School Dist. 139 W. 8 St., 1 and 2 story high school, to Nomellini Constr. Co., Box 542, Stockton, Calif., **$2,643,363.**

**N. Y., Ithaca**—Dpt. P. Wks., State Office Bldg., Albany, Sept. 21, general contract agricultural library and classroom bldg., at New York State College of Agriculture, Cornell University, from John W. Cowper Co., Inc., Sidway Bldg., Buffalo, **$2,536,365.**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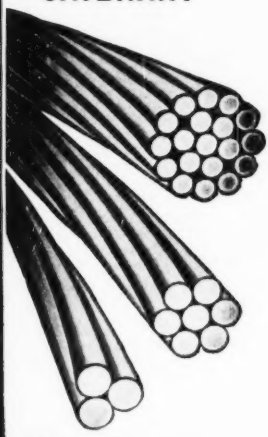

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## Rural Load Building

(Continued from page 111)

ducing more and more farm products. This proves that farmers know how to use equipment to advantage. It also indicates that nothing has played a larger part in this record than the application of electrical energy to all kinds of farm processes.

I. P. Trotter, director of the Texas Agricultural Extension Service says that if farm people are to realize the maximum benefits from electric service, they must have:

**1.** Dependable information on best fitting electricity to their individual operation, and how to realize maximum returns on their investment in electrical equipment.

**2.** Practical advice on planning the farm wiring system for present needs and future expansion with maximum economy.

**3.** Information on selecting appliances best suited to individual farm needs. Type, kind and size are of major importance.

**4.** Training in the care and operation of electrical equipment for maximum efficiency and length of service.

The power supplier must provide an adequate and dependable source of power at a reasonable price, and assume the responsibility of showing his customers how the service can be profitably and efficiently used.

The attitude of the utility's management and particularly of its distribution engineering department must be sympathetic as to the type of service farmers need. Efficient service hangs on this. One company's customers came to me for help in planning a hay drying system. These farmers had not been able to install this much-needed and profitable equipment because the utility not only asked for a demand rate plus energy for the motor with which to operate the fan, but limited the use of the motor to the period between 8 am and 5 pm. There was no objection to the demand charge, but the other limitation made hay drying equipment valueless.

It is true that there are limitations as to what a power supplier can do in economically rendering service; but when these limitations are fully explained, fairly discussed and efforts made to remove them, an unbeatable team is built up between the power supplier and his customers.


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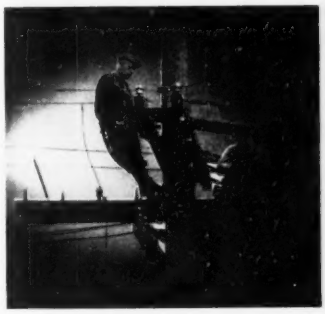

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# BOOK REVIEWS

*Constructive Uses of Atomic Energy.* Edited by S. C. Rothmann. Published by Harper & Brothers, New York 16, N. Y. 258 pages, illustrated. Price $3.

Authoritative papers from various publications and forums have been collected here to give lay industrialists a glimpse of the practicable potentialities of nucleonics for other than military uses. A. H. Compton discusses the world federation proposals in the first chapter, L. W. Chubb the simple mechanics of the atom, and comparable authorities then enumerate the industrial laboratory and process applications, chemical processes, traces technology, ceramics, soil chemistry, biology and medicine. A bibliography and glossary are valuable additions to this non-technical prospectus.

*The Principles of Scientific Research.* By Paul Freedman. Published by Macdonald & Co, Ltd, London EC 4. Price 15s net.

A famed British lamp research engineer felt that there were two categories of people who could profit by having a better understanding of research in science for industrial ends. One is the youth aspiring to succeed in research and the other is the employer who yearns for quick and lucrative success. The book recalls the achievements and the philosophic mood of numerous scientists before philosophizing himself about the planning and organizing of research ventures, the recognition of significant and insignificant phenomena and variances, the conduct of the research with minimum waste effort and observation. Both groups can gain from the peculiarly intimate, versatile and earnest portrayal of purposeful research.

*The Extrapolation, Interpolation and Smoothing of Stationary Time Series with Engineering Applications.* By Norbert Wiener. Published by John Wiley & Sons, Inc, New York 16, N. Y. 163 pages. Price $4.

Professor Wiener is noted for his recent book "Cybernetics" dealing with control and communication in the animal and the machine. This is a mathematical extension of it based on the author's aim to bridge the unwarranted gap between power and communication engineering. At the same time the new techniques are quite pertinent to statistical prognostication because the tooling afforded is useful in filtering the extraneous components so that Fourier methods can reveal the basic periodicities. In short, the analysis is not only conceived in terms of communication engineering but of meteorology, hydrology, geophysics, servos, etc. The technology presented grew out of wartime studies.

*Cold Cathode Fluorescent Lighting.* By H. A. Miller. Published by the Technical Press, Ltd., Kingston Hill, Surrey, England. 130 pages, illustrated. Price 10/6 net.

Gas discharge phenomena are developed as the foundation for tube lighting and then the production of fluorescent lamps is described. Characteristics of operation and a treatment of the requisite auxiliaries precede the chapters devoted to the practical aspects of cold cathode lamps and their application for special objectives. Appended data about the physical and physiological quantities follow a chapter dealing with cold cathode sign and display lighting.


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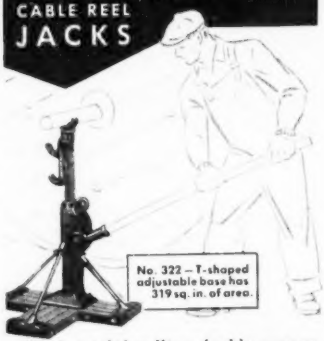


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# LETTERS TO THE EDITOR

## Electric Sales Follow Oil Production

*To the Editor of* ELECTRICAL WORLD:

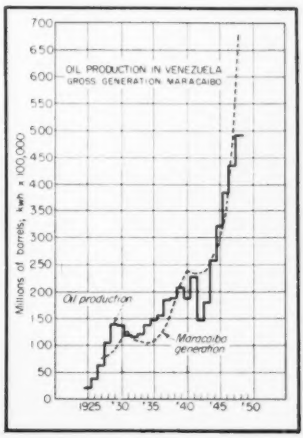
The graphic comparison of Gross National Product and Electric Energy Sales in the United States from 1929 to 1949, on page 75 of ELECTRICAL WORLD for August 27, 1949, illustrates how very closely these are related. With the thought in mind that such a comparison for a local situation might prove useful as a forecasting tool, we plotted the figures for a number of individual electric utilities with rather surprising and interesting results in one case—that of Maracaibo, Venezuela.

As the graph shows oil production for Venezuela as a whole increased from 62,500,000 barrels in 1927 to 490,000,000 barrels in 1948, while power generation to serve the City of Maracaibo increased from 7,500,000 kwhr in 1927 to 68,000,000 kwhr in 1948. In any study of these figures, consideration must be given to two fundamental factors:-

1. Oil production is the dominant and major industry of Venezuela.

2. While 70% of the oil produced in Venezuela comes from the area contiguous to Maracaibo, there is relatively little oil company load in that city, the major oil companies producing their own power in the oil fields.

As a tool for forecasting, the graph shows quite definitely in two periods (1931 and 1940) that in the year in which a slump in oil production first occurs, the momentum of demand carries the generation upward at nearly the rate of increase of the immediately





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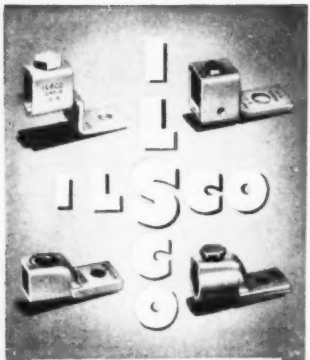

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## LETTERS TO THE EDITOR

*(Continued)*

preceding years. In the three or four years following the slump in oil production, however, there is a definite flattening of the load curve.

Thus it is reasonable to assume that a slump in oil production, even though accompanied by an increase in demand for electricity, will be followed in the next year by a reduced demand for electric service.

Studies of this kind might well prove interesting and valuable in other local situations where a close relationship can be established between economic factors and power demand.

F. Krug
General Manager
Montreal Engineering Company, Ltd.
Montreal, Canada

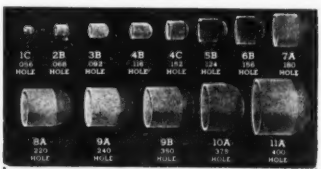
### No Charge of Collusion

*To the Editor of* ELECTRICAL WORLD:

During your recent visit at the Department we discussed with our people the article entitled "Interior Charges Collusion to FPC, VEPCO, in Hydro License Hearing", which appeared in the ELECTRICAL WORLD NEWS ISSUE of June 25, 1949. It was agreed that we would write you our views concerning this article and also provide you with a statement of our position in the Roanoke Rapids matter. I am enclosing the latter statement as a separate document.

I wish to make the following specific points regarding the conduct of Mr. Gregory Hankin as Counsel for the Secretary in this proceeding which are in contrast to the statements contained in your article:

*1.* Mr. Hankin, as Counsel for the Secretary, did not charge "collusion" (as your headline indicates), nor "virtual collusion" (as the text of your article indicates) between members of the Federal Power Commission staff and the Virginia Electric and Power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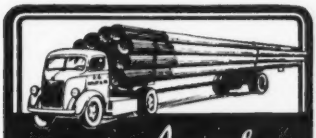
Company, either at the close of the hearing before the Examiner of the FPC or at any other time.

*2.* He did not assert that the Federal Power Commission's staff had conferred before the hearing with representatives of the Army Engineers and the Virginia Electric and Power Company to perfect the Company's construction plans. On the contrary, this fact was brought out by the staff's own witnesses on direct examination, and there was no criticism of these conferences by Counsel for the Secretary.

*3.* The showing in the Secretary's application for reconsideration of the Commission's order denying formal intervention, that the Commission's staff presented evidence and arguments in favor of Virginia Electric and Power Co's application, was not made by way of any attack on, or criticism of, the Commission's staff, but merely by way of statements of fact supported by specific references to this transcript to show that the interests of the Secretary would not be adequately protected by the existing parties. This, under the rules of the Commission, is one of the reasons for granting leave to intervene.

*4.* The article makes it appear that there was "an episode" created by Mr. Hankin's accusation of the Commission's staff, and that Counsel for the Commission "abruptly closed this episode" by agreeing that the staff had approved Virginia Electric and Power Company's plans as representing the best comprehensive plan for early and much needed development at Roanoke Rapids. No such episode ever took place. On the contrary, this forthright position of the staff was stated on pages 21 and 29 of the 2,362-page transcript before there was any opportunity for any statement by Counsel for the Secretary.

Girard Davidson
U. S. Department of the Interior
Office of the Secretary
Washington, D. C.

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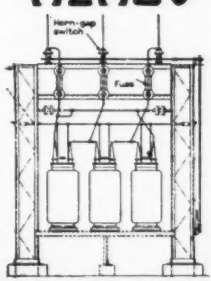


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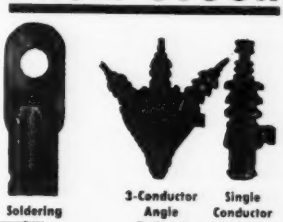


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(Continued on opposite page)

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(Continued from opposite page)

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(101)

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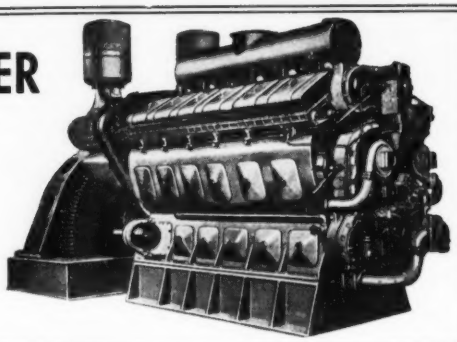

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| 1— | 450 | Whse. | Condensing—250 lbs. 440 v. 3 ph. 60 cy. |
| 1— | 400 | Whse. | Non condensing 125/150 lbs. I.S.P.—5/10 lbs. B.P. 240/480 v. 3 ph. 60 cy. |
| 1— | 300 | G.E. | Non condensing 175/200 lbs. I.S.P.—5/15 lbs. B.P. 480 v. 3 ph. 60 cy. |
| 1— | 200 | Whse. | Non condensing 150/175 lbs. I.S.P.—5/10 lbs. B.P.—240/480 v. 3 ph. 60 cy. |
| 1— | 100 | G.E. | Non condensing 175/200 lbs. I.S.P.—5/10 lbs. B.P. 600 v. 3 ph. 60 cy. |

## SYNCHRONOUS CONDENSERS

| Qu. | KVA | Make | Type | Volts | Speed |
|---|---|---|---|---|---|
| 1 | 5140 | Whse. | | 4150 | 600 |
| 1 | 4000 | G.E. | TSC | 2400/4150 | 900 |
| 1 | 3000 | Whse. | | 2400 | 720 |

## MOTOR GENERATOR SETS
### 3 Ph. 60 Cycle

| Qu. | KW | Make | Speed | DC Volts | AC Volts |
|---|---|---|---|---|---|
| 1 | 2000(30) | Whse. | 720 | 600 | 2300 |
| 1 | 1500 | G.E. | 360 | 275 | 2200/4400 |
| 1 | 1500 | G.E. | 600 | 600 | 4150 |
| 1 | 1500 | Whse. | 600 | 600 | 4150 |
| 1 | 1250 | G.E. | 600 | 275 | 2300/4150 |
| 1 | 1000 | G.E. | 720 | 250 | 13200 |
| 1 | 1000 | G.E. | 720 | 250 | 13200 |
| 1 | 1000 | Whse. | 514 | 250 | 4000 |
| 1 | 1000 | Whse. | 720 | 600 | 2300/4150 |
| 1 | 1000 | Whse. | 900 | 600 | 2300/4150 |
| 1 | 800 | SUGE | 1200 | 240 | 2300 |
| 1 | 500 | G.E. | 720 | 125 | 2330/4150 |
| 1 | 500 | G.E. | 720 | 600 | 4400 |
| 1 | 750 | Whse. | 720 | 275 | 2300/4150 |
| 1 | 400 | G.E. | 720 | 250 | 440/2300 |
| 1 | 400 | G.E. | 1200 | 120/240 | 440 |
| 1 | 350 | G.E. | 900 | 125 | 4150 |
| 1 | 300 | G.E. | 1200 | 120/240 | 440 |
| 1 | 250 | Whse. | 1200 | 240 | 440 |
| 1 | 150 | Cr. Wh. | 1200 | 250 | 220/440 |
| 1 | 140 | Cr. Wh. | 720 | 125/250 | 2200 |

## ROTARY CONVERTERS (60 cycle)

| Qu. | KW | Make | Speed | DC Volts | AC Volts |
|---|---|---|---|---|---|
| 1— | 2000 | G.E. | 514 | 600 | 13200 |
| 1— | 2000 | G.E. | 450 | 600 | 13200 |
| 1— | 1000 | Whse. | 900 | 600 | 11000 |
| 1— | 750 | Whse. | 900 | 600 | 13200 |
| 1— | 500 | Whse. | 900 | 250 | 6600 |

All units can be furnished with AC and DC Control

## MERCURY ARC RECTIFIERS

| | | | | | |
|---|---|---|---|---|---|
| 1 | 1000 | Al. Chal. | B-612 | 625 | 13500 |
| *1 | 1000 | B-B | 25/60 cy | 625 | 6600/13200 |
| 1 | 750 | G.E. | RHW | 575 | 2300/4000 |

*Complete with full automatic A.C. and D.C. controls

## A. C. MOTORS—3 Ph. 60 Cycle

### Synchronous

| Qu. | HP | Make | Type | Volts | Speed |
|---|---|---|---|---|---|
| 2— | 3500 | G.E. | TS | 2300 | 257 |
| 1— | 2100 | G.E. | ATI | 4600 | 514 |
| 2— | 2000 | Whse. | | 2200 | 120 |
| 1— | 1470 | Whse. | | 2300/4600 | 900 |
| 1— | 1000 | Whse. | MILL | 2300 | 189.5 |
| 2— | 900 | Al. Ch. | Eng. (new) | 2300 | 150 |
| 1— | 600 | Whse. | | 440 | 368 |
| 1— | 500 | G.E. | ATI | 480 | 900 |
| 1— | 500 | G.E. | TS-9832 | 4160 | 660 |
| 1— | 450 | Whse. | | 2200 | 128.5 |
| 2— | 350 | G.E. | TS | 2200 | 150 |
| 1— | 320 | G.E. | ATI | 2300 | 600 |
| 1— | 308 | Al. Ch. | | 440 | 600 |
| 1— | 300 | G.E. | ATI | 440 | 720 |
| 1— | 300 | Whse. | Enc | 2300 | 720 |
| 1— | 225 | G.E. | ATI | 440 | 900 |
| 2— | 125 | G.E. | ATI | 440 | 450 |

### Slip Ring

| | | | | | |
|---|---|---|---|---|---|
| 1— | 1000 | Whse. | CW | 2300 | 705 |
| 2— | 700 | Whse. | CW | 2200 | 900 |
| 1— | 600 | G.E. | MT | 440 | 720 |
| 1— | 500 | G.E. | IP | 550 | 505 |
| 3— | 450 | G.E. | IM | 440 | 505 |
| 1— | 500 | G.E. | MIII-IM | 2200 | 450 |
| 3— | 350 | Whse. | CW | 2200 | 900 |
| 1— | 350 | G.E. | MT-442y | 4000/23 | 257 |
| 1— | 300 | Al. Ch. | ANY | 2300 | 505 |
| 3— | 300 | Al. Ch. | ANY | 2300 | 708 |
| 1— | 250 | G.E. | MT | 4000 | 257 |
| 1— | 250 | G.E. | MT-559S | 2200 | 1800 |
| 4— | 125 | G.E. | MT-566Y | 2300 | 435 |

### Squirrel Cage

| | | | | | |
|---|---|---|---|---|---|
| 1— | 250 | G.E. | KT-559 | 440 | 1750 |
| 1— | 200 | G.E. | KT-557 | 440 | 1800 |
| 1— | 200 | G.E. | IK | 550 | 865 |
| 1— | 125 | (new) G.E. | KF TEFC | 440 | 1190 |
| 1— | 125 | G.E. | KF-6328L | 440 | 3585 |
| 2— | 100 | G.E. | KT-543 | 220/440 | 1750 |

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|---|---|---|
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| 50— | 5 KVA | G-E 2300—115/230 |
| 6— | 5 KVA | W-H 13200—120/240 |
| 3— | 50 KVA | W-H 4800/8320Y—120/240 |
| 3— | 50 KVA | Pitts 26400—2300/4000Y |
| 3— | 50 KVA | G-E 13000—2400/4160Y |
| 3— | 75 KVA | W-H 230/460—115/230 DRY |
| 3— | 100 KVA | G-E 11000—2300/4000Y |
| 3— | 100 KVA | G-E 33000—2300/4000Y |
| 3— | 150 KVA | L-M 2400/4160Y—120/240 |
| 3— | 150 KVA | G-E 6600—440 |
| 3— | 150 KVA | G-E 22000—2300/4000Y |
| 2— | 200 KVA | G-E 6900/11950Y—460/230/115 |
| 1— | 200 KVA | G-E 6600/11430Y—2300 |
| 3— | 200 KVA | Mol 7200/12470Y—240/480 25 cyc. |
| 3— | 333 KVA | G-E 33000—2300/4000Y |
| 1— | 400 KVA | G-E 132000—120/240 |

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*Contact* N. C. STIREWALT, *Vice President*

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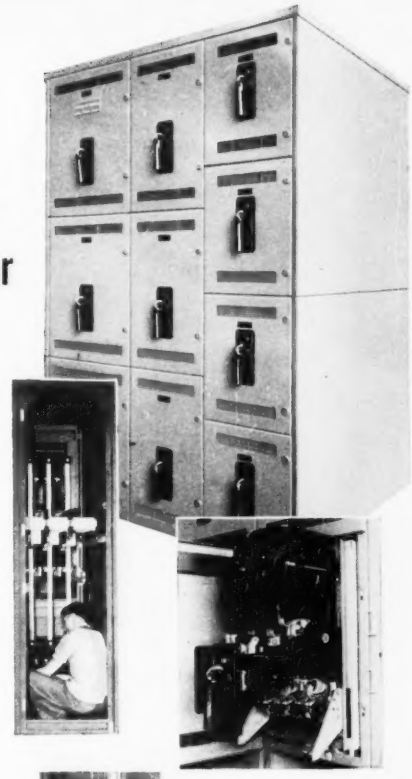
# *Introducing*

# MULTUMITE "600"

## I-T-E's Improved Low Voltage Switchgear with metal-panel circuit breakers







## *New Construction Emphasizes . . .*

### Accessibility

**Breakers:** The I-T-E breakers are completly accessible from all sides. When racked out to the fully disconnected position, all components are in position for inspection and maintenance, even without removing the breaker from the switchboard.

**Cable connections:** Full height, hinged rear doors give easy access to the bus compartment which is so arranged as to provide more space for cable and conduit entry and for making cable connections.

### Safety

The metal panel of I-T-E circuit breakers forms an effective barrier between the bus and breaker compartments and seals off ionized gases.

Control wiring in the bus compartment is now encased in metal wiring troughs . . . an added degree of protection in low voltage switchgear.

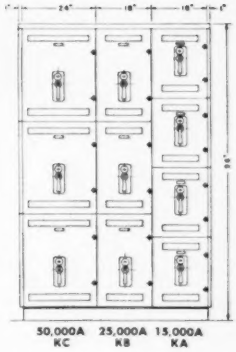
### Compactness

Multumite "600" requires less space. 15,000 amp. IC breakers (KA) can be stacked four-high. Both 15,000 and 25,000 (KB) amp. ratings are in compartments only 18" wide. 50,000 (KC) amp. ratings with or without electrical operation are mounted three-high in frames only 24" wide.

•

Multumite "600" is improved, and yet retains all the extra features that have long been a part of I-T-E quality switchgear. You'll still find the proved pantagraph drawout mechanism, formed doors, end panels and trim; grilled louvers and the famous I-T-E baked enamel finish.

*See your local I-T-E Representative for full information*




**Application: 250 V d-c, 600 V a-c. 15-6,000 amps. continuous ratings. 1 to 4 poles. 15,000, 25,000, 50,000, 75,000 and 100,000 RMS amp. interrupting ratings.**

## *SPECIFY I-T-E FOR DEPENDABLE SWITCHGEAR*

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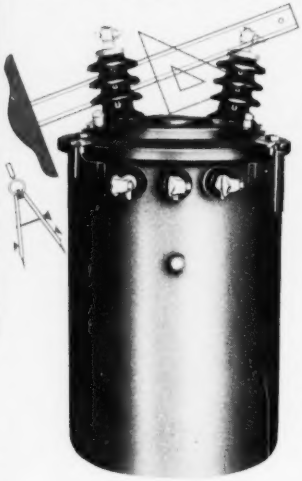
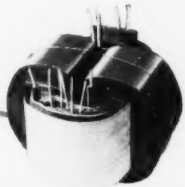


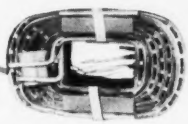
## ALL COMPONENTS OF A KUHLMAN TRANSFORMER ARE "DETAIL-ENGINEERED"

Kuhlman distribution transformers aren't built just to meet required standards. *All components are* detail engineered to provide that extra factor which means easier handling, lower maintenance, better customer service.

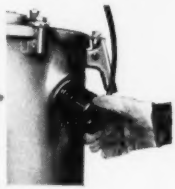
### HERE ARE EXAMPLES OF KUHLMAN DETAIL-ENGINEERING:



**THE BENT IRON CORE.** This pioneering core was developed by Kuhlman only after years of exhaustive, patient research — revolutionized core design when introduced in 1934. Core uses oriented, silicon steel, with resultant reduction in weights, core loss, copper loss, exciting current and impedance.



**WIDE OIL DUCTS.** Kuhlman coils actually contain *more* oil duct space. This eliminates "hot spots," makes Kuhlman transformers cooler operating.



**"QUICK-GRIP" BUSHINGS.** Linemen need no tools when connecting Kuhlman pocket type high voltage bushings. Knob at end controls mortise-type clamping mechanism, so that freeing or securing a line connection is accomplished with a simple twist of the wrist.

Interleaved coil design used by Kuhlman assures low impedance and lower exciting current, which in turn means better voltage regulation. A closely bonded coil structure is attained by dipping in high grade phenolic base varnish, thus eliminating danger of structure becoming loose or disjointed under service conditions.

Vinylite insulation sleeving, which increases in dielectric strength as temperature increases, is used on both primary and secondary coil leads. Reinforced tap coverings and pads are used wherever high voltages tend to pile up. All Kuhlman transformers are filled with oil under vacuum so that no air is entrapped inside.

It is painstaking attention to details such as this that has made Kuhlman the favorite in distribution systems everywhere . . . a worthy consideration for you the next time you buy transformers.

**Kuhlman ELECTRIC COMPANY**
**BAY CITY, MICHIGAN**

**EXPORT REPRESENTATIVES:** *International Standard Electric Corporation*
67 Broad St., New York City, N. Y. Cable Address: Microphone, N. Y.

## TRANSFORMER TOPICS by KUHLMAN

**QUESTION:**

**Three 15 Kva 11000/480 volt transformers are operated in a ungrounded delta-delta bank serving a manufacturing plant. The secondary meter protective gap spills over to ground periodically, especially when the load is disconnected. What causes this voltage between the secondary and ground?**

**ANSWER:**

This is evidently a case of capacity coupling between the primary, secondary, and core of the transformer. A simplified capacity network of a transformer and connected load is shown in Fig. 1. Typical values of capacitance for the installation described would be:

Capacitance HV to LV
$= C_1 = 1000$ micro-microfarads
Capacitance LV to ground
$= C_2 = 1400$ micro-microfarads
Capacitance Motor load to ground
$= C_3 = 100{,}000$ micro-microfarads
Capacitance HV to ground
$= C_4 = 40$ micro-microfarads

Assuming no leakage or absorption, the capacity voltage ratio would be

$$\frac{E_2}{E_1} = \frac{C_1}{C_1 + C_2 + C_3}$$

where $E_1$ is the voltage to the virtual neutral of the HV delta, in this case 6350 volts. The theoretical capacity voltage from the LV terminals to ground at various values of load capacitance are as follows:

| $C_3$ (mmf) | $E_2$ (volts) |
|---|---|
| 0 | 2650 |
| 1000 | 1870 |
| 10000 | 510 |
| 100000 | 62 |

Absorption in the insulation will reduce these values considerably. Where direct grounds on the LV delta are undesirable, the value of $E_2$ can be kept low by maintaining a minimum total LV capacitance corresponding to the desired maximum voltage as indicated above. If the inherent capacitance of the LV distribution network is less than this value, it can be supplemented or "swamped" by a suitable capacitor permanently connected between one LV transformer terminal and ground.

The resonant frequency of the total bank and load capacitance C and the transformer bank inductance L should be sufficiently high to maintain a high effective ground impedance to the fundamental and low harmonic frequencies.

The total bank capacitance,

$$C = C_4 + \frac{C_1 (C_2 + C_3)}{C_1 + C_2 + C_3}$$

Assuming $C_2 + C_3 = 101{,}400$ mmf.
$C = 40 + 990 = 1030$ mmf.

Bank Inductance $L = \frac{2\ (\%1X)\ E^2}{Kva \times 10^5 \times 377}$ henrys, where E = secondary volts and Kva = Transformer Kva.

In the present case, $\%1X = 5.0$ and $L = .006$ henrys.

Therefore the resonant frequency of the capacitance ground is

$$f = \frac{10^3}{377\sqrt{LC}} = \frac{10^3}{377\sqrt{.006 \times 1030}} = 1060 \text{ cycles.}$$

The Capacitances $C_1$, $C_2$ & $C_3$ can be measured by a portable capacity bridge. For all but very small transformers the impedance % 1Z, as stamped on the name plate, can be used in place of %1X.

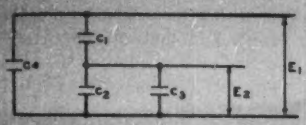



FIG. 1

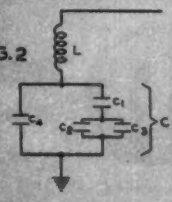



FIG. 2